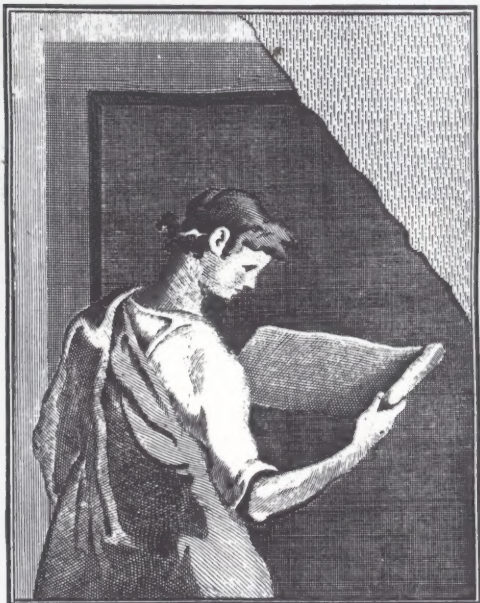
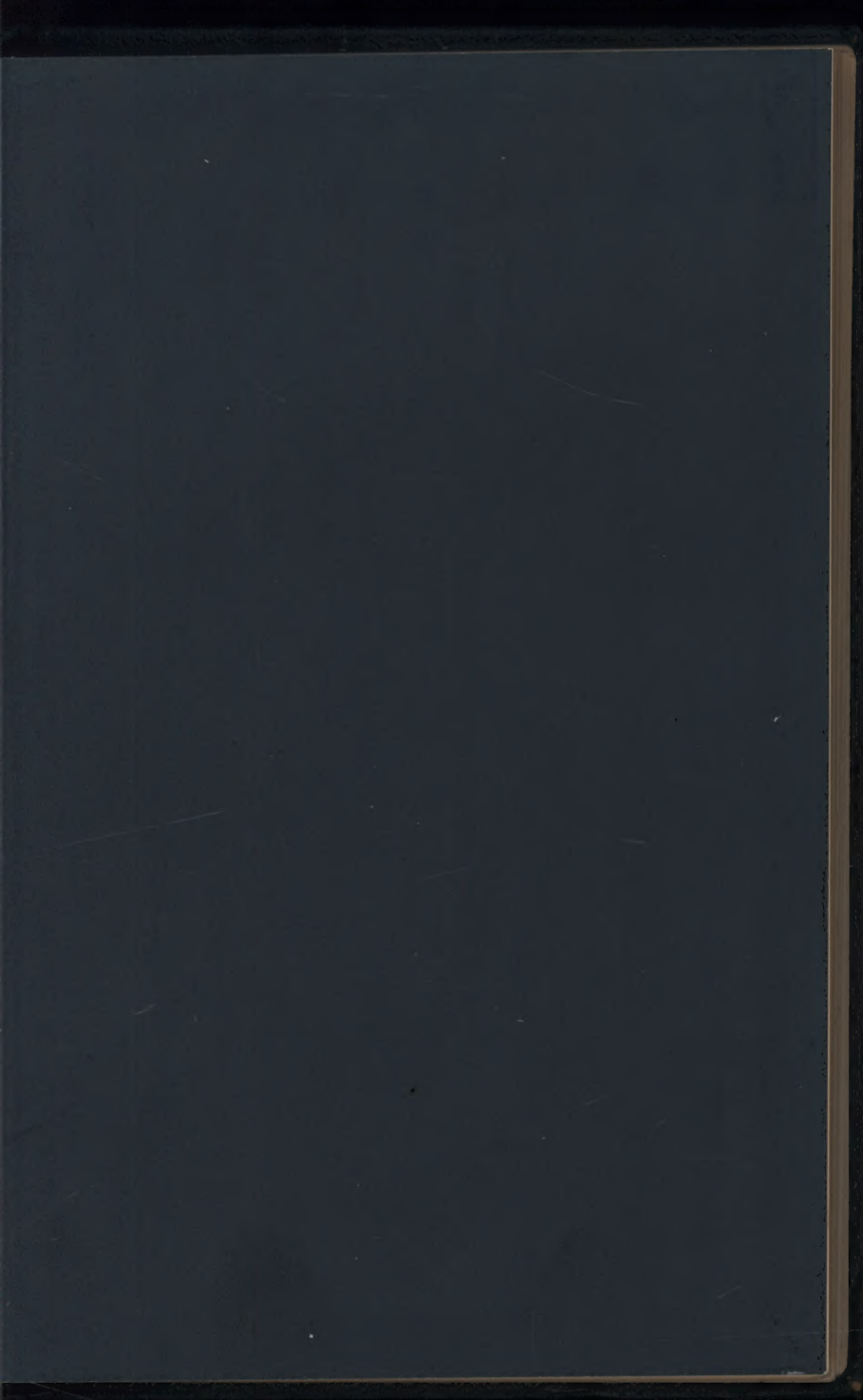


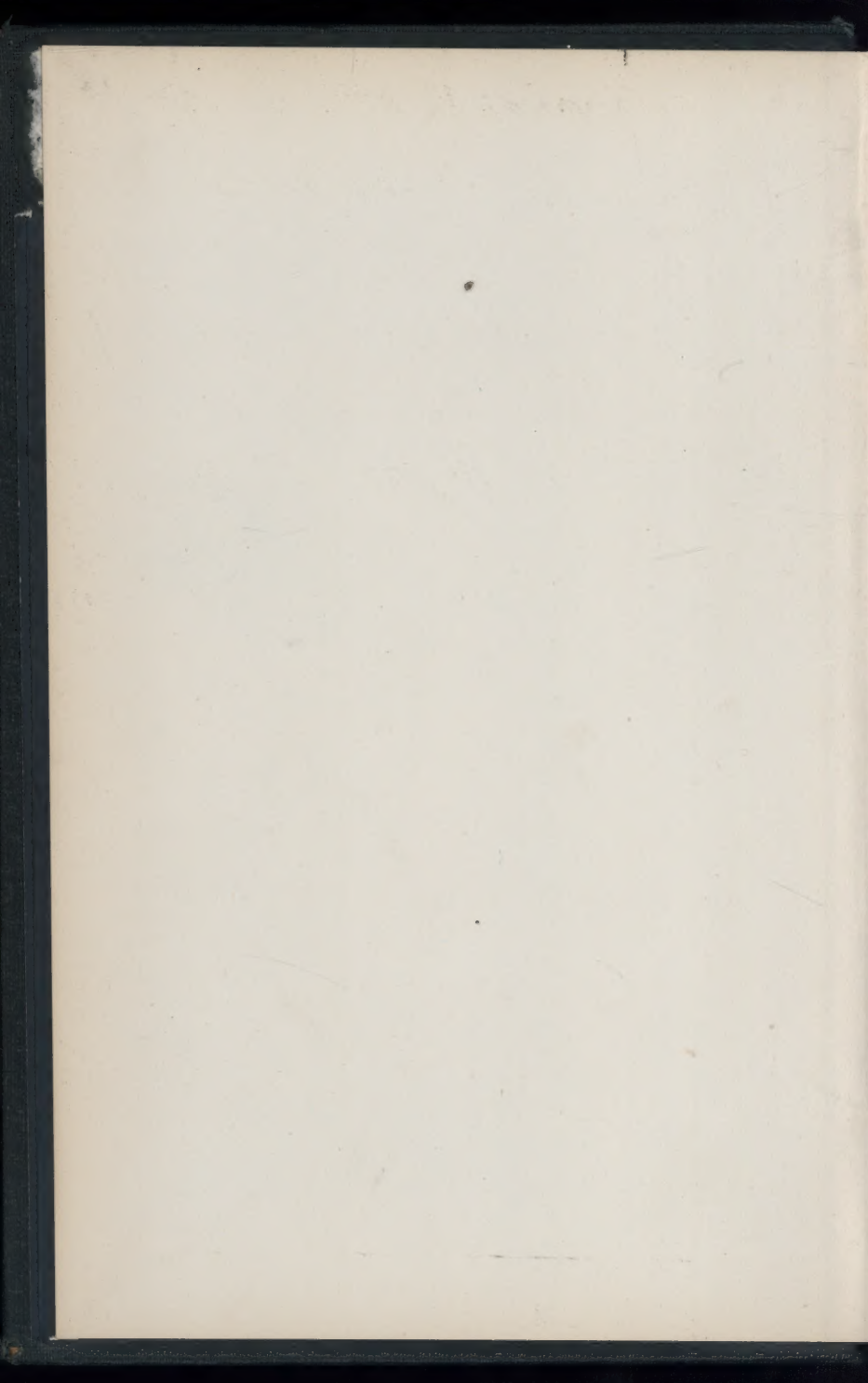
FAULTS IN THE MANUFACTURE
OF WOOLLEN GOODS

N. REISER



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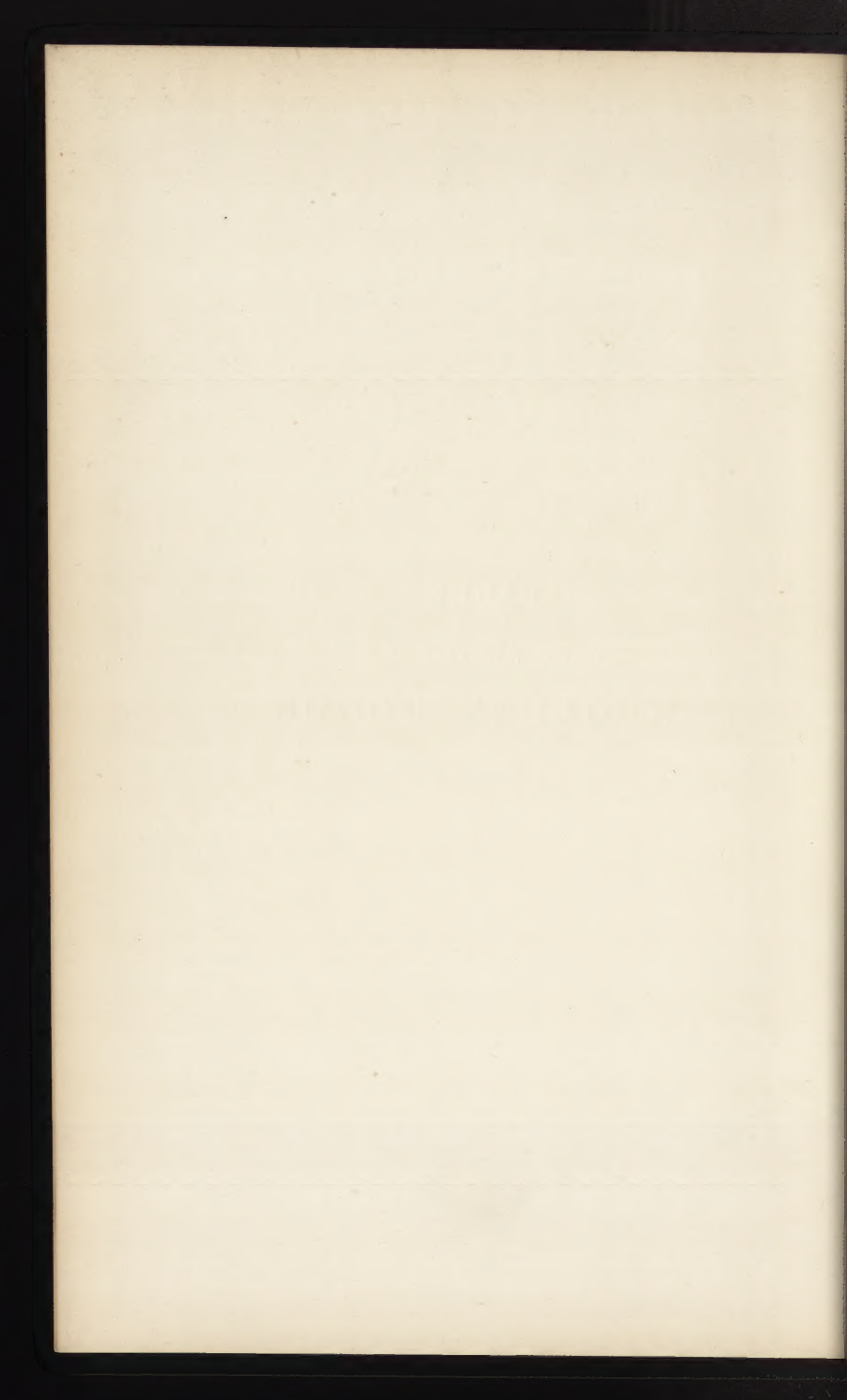
Awarded to
Howard T. Mailey in
recognition of his
Excellent Scholarship
during his Second Year at
the Lowell Textile School.

L. O. Mailey
June 1907

FAULTS

IN THE MANUFACTURE OF

WOOLLEN GOODS



FAULTS
IN THE MANUFACTURE OF
WOOLLEN GOODS
AND THEIR PREVENTION

BY

NICOLAS REISER

DIRECTOR OF THE ROYAL WEAVING SCHOOL AT AIX

TRANSLATED FROM THE SECOND GERMAN EDITION BY
ARTHUR MORRIS AND HERBERT ROBSON, B.Sc.

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PREFACE TO THE SECOND GERMAN EDITION.

THE first edition of this work appeared in March, 1894, and had an extremely favourable reception in all trade circles, so that I am able, which I had scarcely hoped, to proceed already to a second. This shows me that the work has supplied an intimate want of the textile trades, as has, indeed, been acknowledged by the whole of the press connected therewith. To that press I must offer my thanks for the universally favourable judgment which it has pronounced.

I remarked in the preface to the first edition that it is impossible to deal exhaustively with all the errors that may occur in cloth manufacture. Extended researches in this direction, for which I have had many opportunities during the last two years as President of the Textile Research Committee, founded here in 1894, have put me in a position to bring the second edition more in harmony with the present state of textile industry, so that even those manufacturers who possess the first edition may find this a welcome supplement to it.

May the book, in its new form, be still a faithful

vi PREFACE TO THE SECOND GERMAN EDITION.

and useful adviser to the textile trades, when it is a question of overcoming extremely numerous technical difficulties to which they are subject, and may it also, in its modest way, contribute to the progress of the industry. It will then have fulfilled its purpose.

THE AUTHOR.

AACHEN, 1898.

PREFACE TO THE FIRST ENGLISH EDITION.

HERR REISER has carefully corrected and revised the second German edition of 1898, and brought the subject thoroughly up to date for the first English edition by adding some additional matter. One illustration (No. 48) has been added. The sheets have been read by an expert in Bradford.

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LONDON, *July*, 1903.

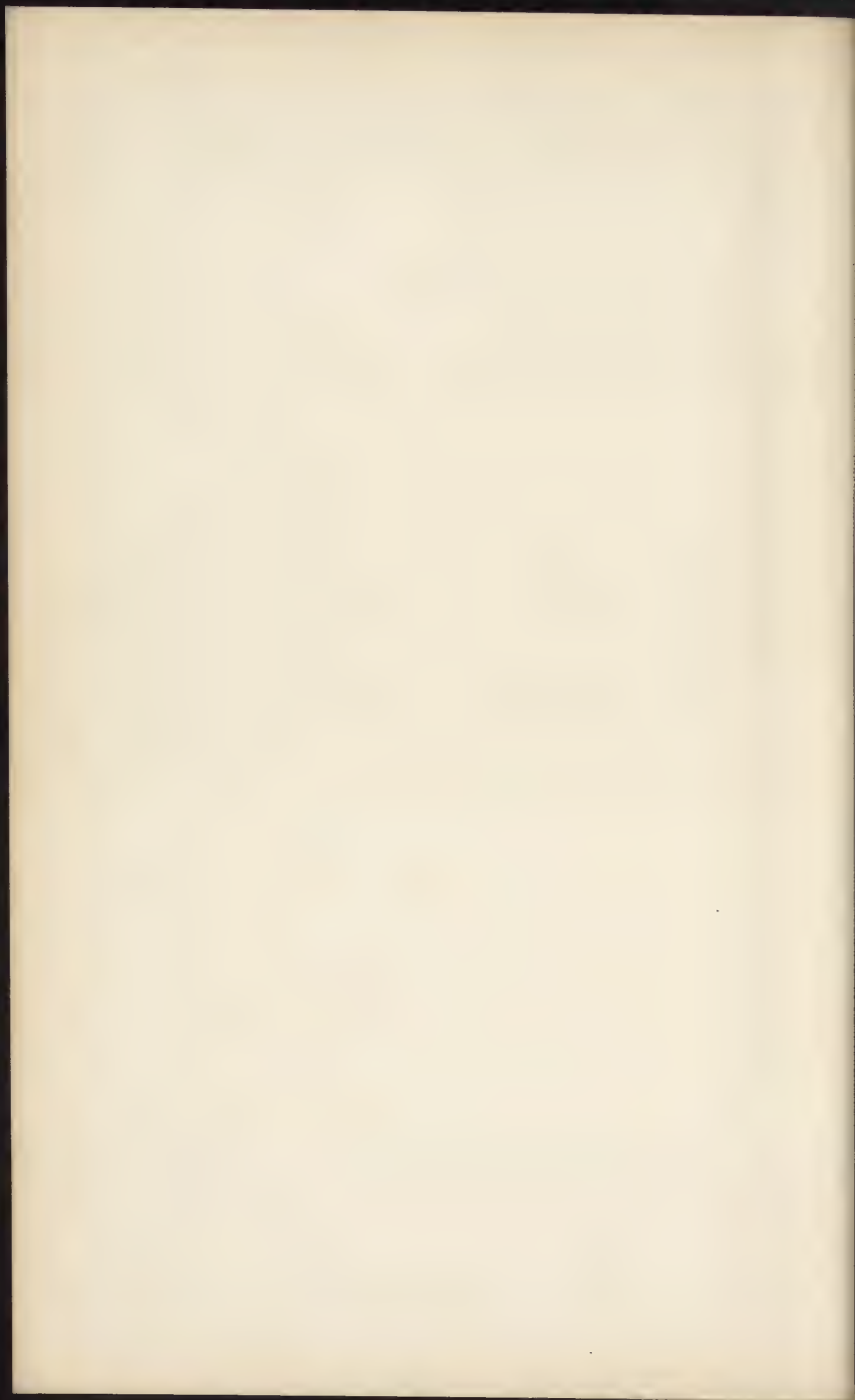


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INTRODUCTION AND SUBDIVISION.

FEW results of human industry require such a complication of processes for their production as woollen carded yarn, cheviot and worsted stuffs. Hence the number and variety of the mistakes to which their manufacture is liable. In what follows I shall speak fully of their origin and nature, and of the means of avoiding and remedying them. If every buyer of woollen cloth knew how difficult it is to turn out a fine and faultless piece of stuff he would not be so prompt to find fault. The following summary of the points to be considered will apply, in many respects, to goods made from materials other than wool.

It appears advisable to adhere to the following subdivision, consisting of these special points:—

1. Improper raw material, or blending of improperly chosen raw material.
2. Wrong treatment of the material in washing, carbonisation, drying, dyeing and spinning.
3. Improper setting of the goods in the loom.
4. Wrong placing of colours.
5. Wrong weight or width of the goods.
6. Breaking of warp and weft threads.

7. Presence of doubles, singles, thick, loose and too hard twisted threads, as well as tangles, thick knots and the like.
8. Errors in woven structure.
9. Inequalities, *i.e.*, bands and stripes.
10. Faulty borders.
11. Defective selvages.
12. Holes and balloons.
13. Rubbed places.
14. Creases.
15. Spots.
16. Loose and bad colours.
17. Badly dyed selvages.
18. Hard goods.
19. Brittle goods.
20. Uneven goods.
21. Removal of bands, stripes, creases and spots.

CHAPTER I.

IMPROPER RAW MATERIAL OR BLENDING OF RAW MATERIAL.

A RAW material is improper when it is not suitable for the article made with it. For example, no short-fibred material is fit for a fabric very subject to hard wear, and on the other hand no long-stapled wool should be used for one which is to have a short thick raising after finishing, or short-stapled wool, noils, or shoddy, for one which is to have no nap.

In blending, mistakes may be made for many reasons, on account of the variety of material, and because the mixing must depend on the special kind of fibre used and on whether it is used for warp or weft. Practice and experience are the best teachers of manufacture. This is nowhere truer than in the extremely many-sided matter of obtaining knowledge of wool spinning, which becomes more and more difficult to acquire with the ceaseless progress of the wool industry, and with the increase in the number of applications which it is called upon to subserve.

In general, however, it may be laid down as a fundamental principle, for making blends which will give good results in spinning, that fibres which differ greatly from one another in staple or fineness must not be put together. To find the limits of difference to be observed must be left in particular cases to the judgment of the manufacturer; and the above principle does not forbid, in special cases—such as the production of particular effects in yarn or fabric—the necessary

2 FAULTS IN MANUFACTURE OF WOOLLEN GOODS.

deviations from the rule. In such cases, however, more than a small percentage of material differing widely from the main bulk is never required.

More glaring faults caused by mixing spinning materials of various staple and fineness will always make themselves felt in the spinning, for it will be found impossible to get any proper union of the fibres and will give a more or less irregular result, and produce a thin and snarly product, especially in warp yarn, and excessive waste of material. For mixing wool so as to get a smooth, strong and elastic warp yarn special care is required. For example:—

1. Long Sydney wools must not be mixed with short fine cotton, or
2. Fine Cape wools with Tertia Buenos Ayres, or
3. Fine noils with cheviot.

CHAPTER II.

IMPROPER TREATMENT OF THE RAW MATERIAL IN SCOURING, CARBONISING, DRYING, DYEING OR SPIN- NING.

ERRORS are made in scouring if the wool is treated with lye which is too strong or too hot or is left too long in the lye. All these errors make the wool hard and brittle. It is another mistake not to clean the wool sufficiently. This may easily happen in warm weather and with freshly shorn wool. Of late, it has been sought to increase the number of baths and to do away with the final cold bath, so as to get the wool less hard.

In carbonising, too strong souring and too long drying must be avoided, as well as too high an initial drying temperature. The material must not be left lying too long in a soured state before going into the drying-room, or the hair will lose elasticity, and there will be an increase of waste in the subsequent processes. For the same reason the neutralising material, after souring, *e.g.*, soda, must be thoroughly washed out.

The raw material is damaged in dyeing if too strong mordants are used, or if the wool is left too long in the dye bath or has to be dyed over again because the first dyeing has not succeeded. Another fault arises from the material being dyed in too short a bath, which causes it to press against the hot sides of the bath without being sufficiently soaked by the liquid.

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If the wool is not properly cooled before lifting by putting the pan on cold stones and then drained in a barrow put over the pan, but is allowed to remain hot and soaked, the following evils occur: By the hot wool coming into contact with the cold stones it is too suddenly cooled and becomes hard. The hot, wet wool piled up makes a solid hot mass, and if it stays long in this heap the wool suffers greatly, especially in the upper layers, as the liquid gradually sinks, and the hot wool at the top becomes too dry and hard and brittle.

A further cause of the hardening of wool is bringing it straight from the hot pan into cold water. Hence of late many factories have adopted the plan of rinsing with lukewarm water, with excellent results. Two water jets are used, one hot and one cold. The former is usually supplied from a jacketed cistern heated by exhaust steam. An alternative is to pass the exhaust through a coil in the cistern. The drying after rinsing must not last too long, nor be done at too high a temperature, or the wool will again become brittle.

Another form of improper treatment of raw material is to mix together wools of different character and weight, and that too in an irregular manner. For example, it is a mistake to put too large quantities of one sort on the heap, when the wool, through its unequal weight, gets partially separated again in the devil. In willeying mixtures care must be taken that the wool does not fly more than 60 cm. or 80 at the most from the opening of the machine. For this purpose a board is placed at that distance to stop the wool (see Chapter IX.).

In spinning, the greatest mistake is to use oils which cannot be saponified in the after washing, so that they form a settling place for all kinds of spots during carbonising, dyeing and decatizing. In spinning, the wool easily suffers by too severe burring or carding, or when the cards are too close together.

CHAPTER III.

IMPROPER SETTING.

By fabrics spoiled by this fault we understand those woven too close or too open. If they are too close, they will not take up enough weft, and spoil the pattern in so far as the correct proportion between warp and weft is not observed. Again the contraction in width in milling is hindered, so that it is difficult to get the goods to the marketable breadth. The same remarks apply to crossing of the threads, for when there are less intersections the warp can be closer set, and more picks can be placed per inch. In other words, with a much interlaced weave we soon reach the maximum of closeness, and no artificial helps, such as soap, oil, acid, or the introduction of steam into the milling machine, are of any further avail.

In milling, we recognise three processes—the milling itself, the shrinkage and the felting of the goods. The shrinkage shows itself both in length and breadth and is, of course, accompanied by an increase in thickness. In the felting the hairs hook and cling together, so as to form a more or less closed mass. Felting and shrinking are not, however, always proportional to each other. A piece may, for example, felt well on the surface, and yet, through too close spacing, may not contract to the same extent. *Vice versá*, too loose spacing will cause rapid contraction without a corresponding amount of felting.

The factors of a good milling are : proper degree of damp-

6 FAULTS IN MANUFACTURE OF WOOLLEN GOODS.

ness, loose twist in the yarn, suitable material, heat, rubbing, suitable crossing of the threads and proper spacing.

To better explain the matter to readers less well acquainted with the shrinkage of goods in milling, I refer to Fig. 1, where *a* and *b* are warp threads. If we take a good material and weave as shown in *a*, as for cloth, the contraction of the goods for normal spacing is much hindered by the threads having to make so many crossings. The fibres thus lie stretched parallel to one another in too small a space to allow of them pushing each other much. In *b* we have only

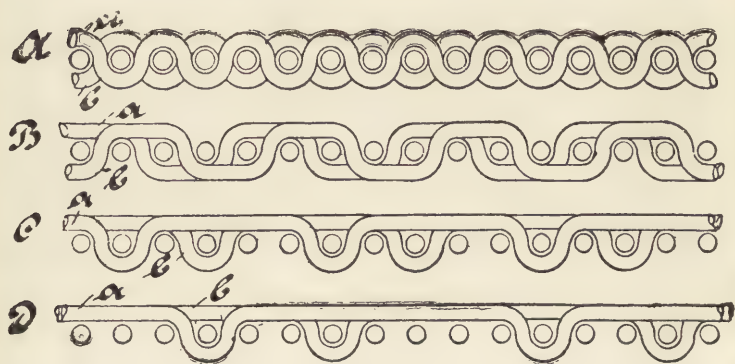


FIG. 1.

half as many crossings. Besides every warp and weft thread is bare for twice the distance it is in *a*, so that it is easier for the threads to ride over one another. In *c* the warp threads cross over four weft threads consecutively, and in *d* over seven consecutively with a correspondingly greater and greater facility for riding over. After this digression we return to our subject.

If the warp is set too close, not only do we get snarls in the weft, but at various places the weft strikes through the warp, and shows point-like appearances, forming the so-called balloons where the weft is cut apart. This happens parti-

cularly when the weft is loosely twisted, and the threads of the warp cross one another much.

If the yarn is very close on the beam, whether by an error of calculation or because a close fabric is purposely intended for some exceptional purpose, the following are the safeguards against the faults in question :—

1. Stretching the warp extra tight. It may happen with a full beam that it is impossible to give the tension wanted, because the beam gives more or less on laying the battens and with the healds. In this case a second stretching beam is much to be recommended. See remarks on beaming the warp too loose.

2. Binding rods over and under the warp, behind the harness, so that at the throw the shed opens well. See remarks on treatment of inserted rods.

3. Arranging so that the shed is as large as possible.

4. Arranging the separate heald shapes, so that the upper and lower ones differ in height by at least a centimetre, whereby the warp is enabled to spring up better. See remarks on warp and weft breakages.

5. Having a rather large wheel with close teeth on the cloth beam, so that the warp is pulled forward at every throw of the shuttle. Coarsely spaced teeth which only act by jerks are to be avoided.

6. Allowing the back roller very little play, so that in the shed the threads are more stretched, and the opening is thus made freer.

7. Taking care that the shed does not close till the shuttle has traversed it completely.

8. Taking as few threads as possible to the reed. The further apart we take the threads the less they hang on to one another. Of course the warp gets more rubbed in the reed, but the shed is the better when the limits of closeness in the reed are not overstepped. Every weaver can prove this for himself by putting twice as many threads to a reed

8 FAULTS IN MANUFACTURE OF WOOLLEN GOODS.

as usual. This bundle of threads hangs much closer together. If then the two groups of threads have a chance to hang together, it will become at once manifest that the shed is not so clear as when there were only half as many threads.

If lengthways in the warp we have places where the threads cross at a large angle; these places should never come in the middle of the reed, but always at the sides, or else, with anything like close spacing, a good springing up of the warp is impossible.

If the threads are too loose, the proportions between warp and weft are again wrong. The warp takes too much weft, does not show properly on the surface and loses too much width in milling. New goods should thus be tested on experimental looms before being treated on large ones.

CHAPTER IV.

FALSE COLOUR POSITION.

THIS can be caused by two circumstances :—

1. When certain coloured threads are wrongly placed by the warper or by the weaver through carelessness in piercing the warp or during weaving.

2. By using inharmonious colours.

A fabric showing faults of the first kind must be remedied by the fine drawers, and the weaver must be more careful in future, and must especially attend to controlling the place of the colours by raising the shafts separately.

In any case he will do well, at the beginning of a warp, to undertake a general control of the colour placing in the master's presence. The band weaving usual in nearly all factories, *i.e.*, the production of striped patterns, which are submitted to the master for examination, is especially necessary when the weaver works at a distance from the supervising master. If the looms are in a badly lighted shed, it is advisable to cut off a piece and examine it in a good light, for it is better to lose a little stuff than to allow mistakes to pass which will make the whole piece of less value, if not altogether worthless. The sample should be taken so that more than the whole pattern can be seen in it, that is to say a part of the repeat should also be shown.

By the second kind of false colour-position I understand the presence of colours which do not harmonise with one another, or which are unfashionable or unsuited to the garment to be made from the piece.

CHAPTER V.

IMPROPER WEIGHT AND WIDTH OF THE FABRIC.

THE first of these heads can be subdivided into two :—

1. Too light a weight of the fabric in comparison with the pattern.
2. A heavier weight of the new fabric than is directed in the recipe.

In the first case the goods are too light ; in the second, too heavy. The first sort can be further subdivided into too light finished and too light unfinished goods, and the second sort in the same way. With many kinds of goods, *i.e.*, those which are washed and milled, especially the latter, and which are too light unfinished, the matter may be to some extent put right by prolonged washing or milling. On the other hand, too light finished goods, which have only just got the marketable width, cannot be so treated, as milling in the length also generally lessens the width.

If the goods have come out too heavy on the loom, and have thereafter to undergo subsequent operations, nothing can be done, because the washing, milling, etc., still further contract the fabric. As a rule, moreover, attempts at the correction of a too heavy finished piece, by stretching it longitudinally, are without avail, as the result is seldom permanent. The attempt to stretch the length and sometimes also the width of a too heavy piece, by first wetting it, is an unreasonable proceeding, because the cloth generally shrinks again quickly.

Before the goods are so strongly stretched, especially in width, the underside is strongly raised. Of course, these too heavy goods are only disadvantageous to the manufacturer if sold at the rate quoted for light patterns. With the present competition and price cutting, which demand accurate calculations, every detail in the manufacture of the goods must be attended to. Of these, one of the most important is the quantity of raw material used. Many manufacturers reckon the stuff roughly only, and do not consider that pence soon mount up into shillings. In making the pattern one should reckon and book accurately how much warp and weft go to the running yard, and also compare the width of the unfinished with that of the finished fabric, so that the contraction may be taken into account. These items must not only be calculated and booked, but must be remembered during the actual process of manufacture, so that the goods may be made to pattern and conform to the calculations previously made.

CHAPTER VI.

BREAKAGES IN WARP AND WEFT.

BROKEN warp threads cause injury to the fabric through the absence of entire threads or parts of them. In like manner parts of threads or whole threads may be missing from the weft.

These breaks, whether in warp or weft, vary in importance. In a single-coloured wool fabric, *e.g.*, with a raised finish, the want of a few threads is of little consequence, and the same is the case with parti-coloured goods if one out of a large number of threads of the same colour is missing, provided that the goods have a finish raised to some extent. The case is different with broken coloured threads, which become very visible with a smooth finish. Breaks on the wrong side of the fabric are of course of less importance than breaks on the right side, but even with them something must be done in many cases, *e.g.*, when the wrong side is finished smooth, or when conspicuous coloured threads are missing from the wrong side.

Here I may mention a common fault in the better class of goods, the so-called weft cuts, which give many manufacturers much trouble. These are small places where the weft is just cut, and very often only over a crossing place. They are more or less evident according to the point of view. They may occur in thousands in the same piece, and are most injurious in fine piece-dyed goods which are finished smooth (see Chapter III.).

These cuts arise (1) when the warp is rather close; (2) when there is a good deal of crossing of the threads; (3) when a sharp reed is used; (4) when there are hard patches of size on the warp; (5) when there are knots or burrs in the warp; (6) when cuts or other sharp-crossing places come to the middle of the reed, whereby an open shed is made impossible with close spacing (see Chapter III.). In the first two cases the opening of the warp is not sufficient, and some of the threads get in the way of the shuttle. In the third case, the sharp reed acts like a knife. In the fourth case the weft is rubbed against the hardened size. In the first two cases the evil is remedied by spacing the warp a little more openly, or by causing the leaves to rise somewhat unequally so that the lower leaves hang 1 to 1½ cm. higher or deeper than the others. In the third case we grind the reed a little, or turn it back to front, if the back is still usable, or replace it by a fresh reed. In the fourth case, I refer to the remarks on bands lengthways of the warp.

Longer or shorter breaks in the weft occur if with bad weft yarn the weft tears in its course, and then begins again, or when the spools are not uniformly wound, or when they contain knots or burrs, or with old yarn which by damping or careless greasing has become sticky, or when the cops are wound closer than the shuttle, or if the shuttle case is too long, or if the shuttle-hook is indented, when it easily catches the weft, especially at uneven places therein, and at the end of the spool, as then the yarn is more stretched, or if the weft gets caught between the shuttle and the box. It is then easily kinked, and breaks with the least pull, as it runs off the spool, and catches again more frequently. A last case is when the weft lies on the shuttle race, and the shuttle coming out of its box strikes it, so that it is injured, and made easily breakable.

The above faults can almost always be remedied by inserting new threads into the piece. This must be carefully done,

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for badly sewn-in threads are as bad as, or worse than, missing, thick or tight threads. In stitching, improper yarn must not be used, *i.e.*, yarn of other material wrong in thickness or colour, and for already scoured goods only scoured darning yarn. If this is not done, the dirty threads will show in the fabric later on and will also be tight.

A few remarks on stitching may be made here. As a rule, it is only done after washing the pieces in the case of colours and faults hard to recognise. Pieces in which weave and colour appear clearly should be stitched before washing. In goods which are not milled the new threads hide themselves more easily and get better into their intended places, as do the threads neighbouring those sewn in, and if a little displacement and felting take place in washing it is the same in any case.

Besides the cases mentioned above, in which stitching is required as a remedy, we have the same remedies for some others, as follows:—

1. In coarse cloths single missing threads are not replaced, but only several missing in the same place.

2. In piece-dyed cheviots everything is stitched in articles shorn smooth, both in warp and weft, and also the knots in strong yarns. In such goods with a raised finish, stitching is only resorted to in cases when the ground is not fully covered with nap. In coloured cheviots, whether the missing threads are warp or weft, all are sewn in, even if the goods receive a nap after finishing.

3. In black cloth, with a slightly raised finish, single warp and weft threads are not as a rule replaced, but thick warp and weft threads must be pulled out and replaced by normal ones, as a rule.

4. Twills with raised finish are treated like black cloth, *i.e.*, not stitched.

5. If in satin or atlas of five leaves a warp thread is missing, another is pulled out. But if a weft thread is wanting,

this gives a sequence of eight unbound warp threads. In superior goods the missing weft thread is stitched in, and in inferior qualities the long bare warp threads are cut off.

6. Doeskin is treated like atlas.

7. With coloured worsted with raised finish, in which several threads are missing close together, at least a part of them are replaced, especially where there is any very conspicuous gap. The same is true as regards misses on the wrong side. If there are too long uncovered parts of the under weft through the absence of under warp threads, the missing threads must be sewn in, or else in washing and especially in milling ribs or lumps will be formed. The same is true when there are misses in the under weft.

8. In piece-dyed worsteds with smooth finish all must be replaced on the right side, but single threads on the wrong side need not be stitched in, unless there is danger of the formation of ribs just noticed.

9. In dyed carded wool as much as possible may be sewn in on the right side, but on the wrong side only if other threads are left bare too far or if conspicuous threads are missing.

10. In piece-dyed carded stuff, with smooth finish, everything must absolutely be replaced on the right side, but with a raised finish the replacement of single threads seems usually superfluous.

11. Conspicuous diagonals, ribs, cut fabrics, etc., must be completely stitched in on the right side, especially if they are to have a smooth finish.

12. In fine eskimo styles, both warp and weft are stitched in on the right side, including all under warp and under weft threads. In cheaper goods, single over warp threads are not replaced, but single upper weft ones are. There are factories where single under weft threads are not replaced, but an expert can easily recognise these places on the right side, for it is vaulted over those places.

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13. In heavy weft-faced fabrics finished with a nap or pile for overcoatings, everything, even the smallest end, must be stitched in, and the thick knots must be removed, and replaced by a good piece of weft. Here the fine-drawer must take care that she does not stitch in too small ends, because these are torn out by the raising gig. In some factories it is usual to sew the short end on the wrong side. This side is as a rule less important, because in these classes of goods it is always well hidden by the raising. Here, therefore, single weft threads need not be replaced, and those in the under warp only when otherwise too much under weft would be left bare.

14. In overcoatings with a coloured reverse side, the remarks under the last head apply to the right side, but everything must also be stitched on the wrong side, and the more so because these goods are usually only made in good qualities.

Before the piece goes to the fine drawer, it is examined by the overseer, and marked with blue or red chalk in the places to be mended. Only such chalk is to be used as can be completely washed off.

As a rule the fine drawer cannot be trusted to see the faults at once. In fact it is scarcely possible she should do so, because the piece usually lies crumpled or folded before her.

In many cases, especially with single coloured goods, if the ratio-number of the weave is small, as in cloth weaves, with three, four or more shafts, the evil may be remedied by pulling out other threads in the weave ratio, where threads are missing, then wetting the place and combing it with the instrument represented in Fig. 2, or by scratching together with a needle threads at some distance from one another. If, for example, a single thread is missing in a plain cloth, we naturally get at the place a doubled thread, *i.e.*, two threads which cross exactly equally. If we remove one of these, a

regular crossing again shows itself. If a single thread is wanting in three-leaved twill, and we remove two more threads, we again, of course, get the proper crossing.

There are factories which for special work such as above described always employ the same workwoman, who thus becomes very expert.

The pulling out of threads is however only advisable in goods which are afterwards thoroughly washed, and still better in those which are milled and also those which receive a raised finish. But the procedure is not advisable with goods which are finished smooth, and may even be dangerous under circumstances, and take us from the frying-pan into the fire.

The carrying out of this form of remedy is more suitable for the weft than for the warp, because if one thread is missing the stroke of the batten always sends the next one nearer to the last. This does not happen with the weft, but a permanent gap remains. Some weft breakages, especially in very short places, often arise from bad yarn, especially with sharply crossing weaves, where the warp threads of the upper and under sheds are not well separated. If now a rather weak weft is inserted, and the batten presses on it, it often happens that the weft is simply pressed through at those places, forming faults in the cloth (see pp. 6 and 12).

I also refer the reader to the next chapter. Before I pass to it, however, I will explain the manner of sewing in by a sketch. Fig. 3 shows a four-leaved twill, with a thread missing in the middle.

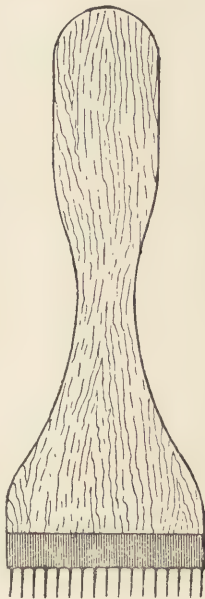


FIG. 2.

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a is the needle and *f* the thread. It is evident that all thread replacement is not so easy as in four-leaved twill. Practice is required, and, if possible, a knowledge of the various weaves.

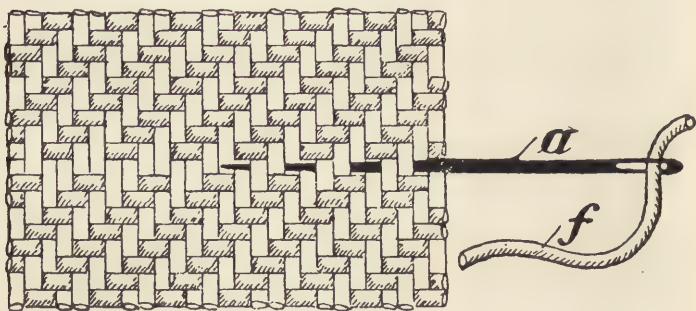


FIG. 3.

All fine drawers ought to be thoroughly instructed in this at the beginning of their apprenticeship, both as regards simple and doubled and strengthened fabrics. Then we should not see inserted threads making the appearance worse instead of better.

CHAPTER VII.

DOUBLE, SINGLE, THICK, LOOSE, TIGHT OR TOO HARD TWISTED THREADS, SNARLS OR THICK KNOTS.

DOUBLES are threads of the warp which lie together and have the same crossing, while each thread ought to cross separately, or in the weft two threads in one leash, where there ought to be one only. In both cases the evil is easily remedied by removing one of the two threads.

Single threads are those warp threads which in the harness are not drawn in in the right order. They must be pulled out if the price of the goods is high enough to allow it, and replaced by properly crossing ones by the fine drawer.

Thick threads are those in warp or weft which are distinctly thicker than normal but are of the same material and colour. If their colour is injurious, they are removed by the fabric and replaced by normal threads. If the pulling out is carefully done, *i.e.*, if they are pulled out piecemeal, the new threads are easily inserted in the same places. In difficult designs great care is necessary, for it is very easy to insert the threads too tight, because they contract so readily. The common practice of sewing the normal threads to the thick threads, so as to get the right threads in after pulling out the latter, is not to be recommended, because the normal thread gets too twisted in being inserted and is then itself faulty. The thick thread untwists in the pulling out, and the twisting it loses is transferred to the new thread. These thick

threads can usually be avoided by an attentive spinner or weaver who carries out his duties conscientiously. Thick threads also arise from uneven slubbing :—

1. When two or more slubbings run together in the condenser rubbers.

2. If the slubbing runs unevenly.

3. If the slubbing has by any means become too thick in certain places, as through folding in putting on a new slubbing.

4. When in the spinning frame, whether self-actor or any machine serving the same purpose, two or more threads are spun together.

5. When the piecers who mend broken threads during spinning get them too far apart.

6. When the cops are too full in spinning, so that as the carriage runs forward some turns wind off the cop and get with the new thread. This mostly happens where the guide-wire is bent upwards.

7. When in twisting together two or more threads of unequal thickness, or a larger number than is proper, are twisted together.

With regard to these thick threads I should like to remark that there are factories in which thick threads are pulled out and replaced by normal ones, at the expense of the weaver, and others where it is done at the expense of the spinner. I think that it would be best to follow a middle course, and share the cost between them. Both will then be impelled to prevent the occurrence of this fault.

As regards slack threads, they occur both in weft and warp, especially the latter. In the warp they arise from threads which have got too slack in piecing or threading the healds when a thread breaks behind the harness or over the yarn-beam, and the weaver does not at once notice it. The thread then gradually gets more and more straggling as compared with the others. Besides by too loose beaming, or carelessly

laying in the raddle, too wide placing of the yarn-beam flanges or by tangling of the threads in beaming before raddling.

Here I should like to call attention to some special cases of slack threads, *i.e.*, such as arise during weaving double cloths through tying the backing weft with a part of the face warp only. If this happens the tying threads weave in strongly, and the others, which have not been tied, gradually become slack. This can only be remedied by using a second yarn beam, or by making every warp thread bind or tie with the back. See remarks on tight threads.

In the weft loose threads arise from various causes, especially

1. Through too sharply crossing weaves (see p. 6).
2. By too close spacing (see p. 6).
3. By too small a shed.
4. By closing the shed too late.
5. By the weft running too loose from the spools.
6. By the shuttle striking back or rebounding.
7. By the weft running from the shuttle at one time easily and at another with difficulty from a badly wound spool.
8. By the shuttle case being too far from the goods.
9. By the weaver handling the weft badly.
10. By so-called size spots or warps sized too hard, as already remarked on p. 13, the weft by striking the rough over-sized places catches, and so often gives rise to weft cuts.

I must here call attention to a special condition of the warp threads which are often, but incorrectly, called loose threads. I mean such threads as appear in satins, corkscrew, granite and other warp effects, and lie out over the others. This fault often arises from too much closeness in the warp, so that the threads through inequality or any other hindrance do not sink in deep enough, as they can find no room. Here only more open spacing can help, except strong stretching and what has been said on p. 6.

In all cases, whether we have to do with loose weft or

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loose warp threads, they are carefully pulled tight and the too long ends here and there cut off. With awkward goods this cutting must also be done on the wrong side. Care must, however, be taken not to convert too loose threads into too tight ones.

Too tight threads in the warp result

1. From careless setting up of the spools in warping, *i.e.*, setting them up slanting.

2. When the spool in warping jumps out of its mount, and the warper goes on with his work with the spool unrolling itself on the floor. The thread by the constant checks it then experiences almost always gets too tight.

3. When the hooks on the spool frames are too open, and

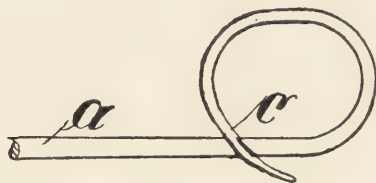


FIG. 4.

the threads when wound off quickly get round the hook a second time. These hooks must either be quite closed or have the form shown in Fig. 4.

This double looping of the thread round the hook gives the tightest and the worst threads. If the hooks are quite closed or made as shown in Fig. 4, this is impossible, but a hook as in Fig. 4 is to be preferred to a closed one on the score of convenience. The hook in the figure is supposed broken off at *a*, and at *c* its point goes below the lower part.

4. Tight threads are also caused when on beaming before raddling threads get snarled, and are not disentangled because the thing is not noticed.

5. If the warp is beamed too loose or with unequal tension,

so that when wound off it partly cuts in and is loose at first and too tight afterwards.

6. Too tight threads may be the fault of the weaver if he brings so-called "helping threads" too tight into the warp. Many weavers are in the habit of hanging weights on these threads, and for convenience' sake the threads are thrown over the stretching beam with the weights already on them. If then the thread is rather too long, it is too loose at first because the weight is resting on the ground. Presently, however, the weight, usually an iron reel, is lifted, and catching under the loom or against a basket or box, makes the thread too tight, and may untwist it.

7. By joining a broken thread on the loom without inserting an extra piece.

8. By inserting threads too tight in place of missing ones.

9. When metal healds are used, and the heald eyes are not quite closed, the warp threads get caught in the openings. This causes tight threads and also dull places, the first because the threads catch, and the second because they get rubbed in so doing. This latter effect is most noticeable with silk and lusted yarns.

10. When harness is used, and the heald with its eye turns during the work, so that the thread gets entangled in the heald, and catches with the least unevenness of the thread. This is particularly awkward in beginning a new warp. During weaving it occurs mostly in changes of weather, as the heald turns more or less according to whether the weather is wet or dry. This turning can be prevented by putting an eight-fold cotton thread between the heald and the harness cord. This makes an intermediate piece of 50-60 mm. without knots and receives the turning of the upper cord without communicating it to the lower heald. If we wish to do more, we let the harness run empty for a few hours, for as soon as the weight hanging on the heald acts on the harness cord by rising and sinking, the heald generally turns itself a bit loose.

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11. Small bits of tight warp or weft threads also occur if the weaver or the burler tears off ends sticking up from strong yarns, thus making more or less of the rest of the thread tight. It is thus advisable in working with the stronger yarns to forbid tearing off ends and to have them cut off.

The following are the causes of tight threads in the weft :—

1. When the spools are too thick or unequally wound.
2. When the spools are too long for the shuttles.
3. When the spools are put askew into the shuttles.
4. When the spools are not smooth pointed.
5. When there are too thick knots, burs, etc., in the yarn on the spools, and the thread as it winds off catches on them.
6. If the weft catches in the shuttle in any way, by defective construction or by driving the weft too tight, as many weavers do, or when the loop in the shuttle is so open that the thread catches in it. I have known an actual case in which tight weft threads came at intervals of 40 to 50 cm. After long investigation I discovered that the shuttle had a crack in it, which caught the thread winding off from the spool for a moment. When another shuttle was used, the trouble disappeared. See "bad edges".
7. In old yarn long wrapped up on dirty or rusty reels, so that it sticks to them. See "cross striped from after-spoiled weft yarn".
8. When a spool is nearly exhausted, many weavers are accustomed, when the end of the thread reaches nearly to the other side, to pull the weft till it does so completely. This must certainly not be done, because it makes too tight weft threads.

The so-called untwisted warp threads which are very conspicuous are very likely to occur with loosely twisted yarn, particularly if the warp is sized very little or not at all. It is then easy, if the warp is spaced rather close, for untwisting to happen, especially with cheviot and loose-twisted yarns.

In fine and sometimes with less valuable goods too tight weft threads must be put right. This is done by cutting them out piecemeal and replacing them with new threads.

Too hard twisted threads arise besides too thick threads, usually from spinning, when some spindle bands are more stretched than the rest, and also from want of attention in mending broken threads in the mule, holding them too long in mending them and letting the spindle run. Then the part between the spool and the hand of the mender gets extremely tightly twisted, which with carded yarn is very injurious. See also No. 6, p. 20.

Snarls may arise

1. By too tight twisting of the yarn, especially when the weft yarn is used unsteamed or unwetted.

2. When thick knots, burs, etc., occur in the warp and catch the weft as it passes through.

3. When hard yarns, *e.g.*, cheviot, cross-bred wools, mohair, etc., are used in warp or weft or both, and have been carelessly treated in washing or milling. If such yarn is used in the warp only, snarls are avoided by preventing shrinkage in length. If it is only in the weft, the goods must only be treated in the full-width washing machine just long enough to get rid of the oil and dirt, and care must of course be taken that the piece runs without any creases. If the yarn is in both warp and weft a faultless article is rather to be got with the full-width washing machine, or better, by soaking the goods in hot water before washing and milling or by boiling them in a madder vat.

As regards thick knots, the menders, warpers, spoolers and weavers should be distinctly forbidden to make double knots, weavers' knots or birdshead knots, which usually cause the difficulty in question, especially with a strongly crossing weave.

4. If, as already remarked on p. 21, the shuttle boxes stand too far from the selvages, so that the returning weft is made too loose at the sides.

5. If the weaver puts into the weft two or more yarns of different twist, whether in amount or in direction of twist, and the yarns get tangled outside the selvages, *i.e.*, between them and the change boxes, and a thread gets into the fabric with the others. To remedy this guard threads, known to every weaver, should be put between the selvages and the change boxes and weft threads.

6. If in exceptionally close spacing there is a somewhat sharp crossing snarls occur in hard-twisted weft, and cachettes in loose-twisted weft.

7. If in cheviot, mohair or similar yarns creases are formed in washing or milling, so that the stiff weft is pressed through in the folds.

8. If in many fabrics, *e.g.*, mat and warp cord, the selvages, as in other double weft goods, are not bound, so that the weft in changing its direction gets hold at the sides, or when a guard thread is used at the side and breaks occasionally and is not at once repaired or does not rise and fall properly. With these snarls, broken places also occur from faults in the weft.

With such snarls as are indicated in No. 6, the machine on a mechanical loom must be opened early, and the shuttles must not be thrown too soon or too hard. Not too hard to prevent the shuttle from rebounding from the other side. At the same time the beam receiving the finished goods must pull strongly. Getting rid of other snarls is such a simple matter that it is unnecessary to say anything about them.

CHAPTER VIII.

FAULTS IN WEAVE STRUCTURE.

STRUCTURAL faults may arise in various ways. For example :—

1. By ignorance or carelessness on the part of the pattern designer various faults arise, *e.g.*, when the weaves contain simple false crossing places, whereby the regular crossing is unintentionally interrupted ; or by the juxtaposition of various weaves, which do not harmonise in taking up the weft or in washing and milling ; or in double fabrics, when the weaves of right and wrong side behave differently in washing and milling ; or through using weaves which leave too wide spaces bare in weft or warp or in both, and which do not give the fabric the solidity suitable for its purpose.

2. By wrong cards, whether in a power or hand loom.

3. By wrong lifting of the leaves or harness. This can happen in power looms with roll cards, *e.g.* (*a*) with bent card rods ; (*b*) with worn-out or unequally thick card rollers ; (*c*) when the card rollers do not stand exactly under the sinkers ; (*d*) if the cylinder stands too low or too high ; (*e*) if the cylinder closes too late or too early ; (*f*) if the card rollers do not close sufficiently ; (*g*) if rollers and boxes are interchanged, as often happens in factories possessing different kinds of looms ; (*h*) with worn-out sinker noses, etc.

4. When the weaver does not find the right junction in back weaving or drawing out the weft.

5. By wrong insertion of threads.

6. By too closely spaced a harness or when too thick cords are used for it and also when the cords are too thickly varnished at the tying places. In these cases, it only too often happens that the healds at the knotted places, especially with sharply crossing weaves, rise with them. This happens particularly when the loom is working fast.

7. If harness is used, with metal healds, and if some of them are bent, as often happens, these overlap during the weaving and cause faults.

CHAPTER IX.

INEQUALITIES IN STREAKS AND BANDS.

WE here distinguish three entirely different stripy inequalities: (*a*) lengthways in the warp; (*b*) lengthways in the weft; and (*c*) in various diagonal directions.

The three have usually quite different causes, so that they will be considered separately.

(*a*) Stripes in the warp result

1. By uneven yarn.
2. By uneven warping.
3. By careless or defective sizes or imperfect drying of the sized warp.
4. By defective stretching of the warp.
5. By defective beaming of the warp.
6. By defective turning of the threads in tying on the warp.
7. By wrong treatment of the warp during weaving.
8. In certain goods by having too many leaves, or by putting the harness board too wide in the harness.
9. By defective harness.
10. By an unevenly spaced or defective reed.
11. By irregular reeding.
12. By wrong weave or colour position.
13. By wrong treatment of the goods in knotting.
14. By wrong treatment of the goods in washing, carbonising or milling.
15. By wrong treatment of the goods in raising.
16. By wrong placing or unequal sharpness in the shearing

knives, or uneven cutting caused by unequal dryness of the piece.

17. By defective roller-pressing.

18. Stripes in drapé goods.

I. INEQUALITIES FROM UNEVEN YARN.

These may arise

1. By defective mixing of the various raw materials,

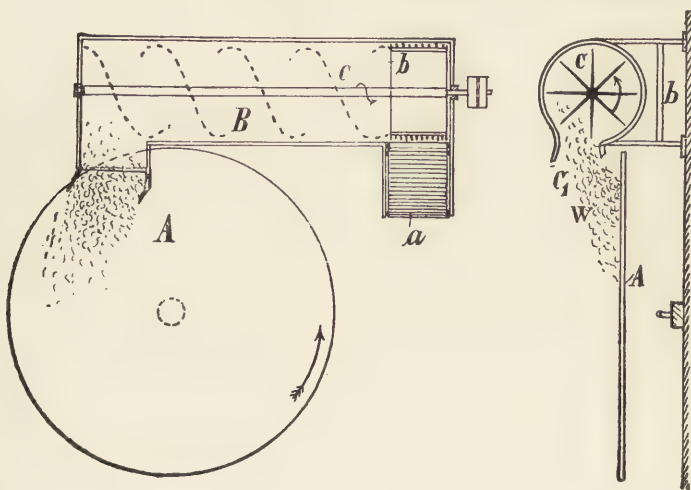


FIG. 5.

whether they differ in quality or colour, for example, when too thick layers of material are placed on a blend.

2. By defective willeying. This must consist either in not willeying often enough, or that in mixtures of light and heavy wools the former fly farther out of the willey than the latter, thereby causing want of uniformity in the mixture.

Of late, willeys have been provided with an arrangement to prevent this. This arrangement consists of a rotating horizontal disc, on which the wool falls as it leaves the

willey, and is intended to remix it. Fig. 5 shows a willey provided with this apparatus.

B is the willey, and A the rotating disc, *c* the vanes, *a* the feeder of the devil, C' the cover and *w* the material. The diameter of the rotating disc is from $2\frac{1}{2}$ inches to 3 inches. The material must not alight too near its centre or it separates again. If it is kept near the circumference this is prevented.

3. By unequally strong yarn of the same material and colour, *i.e.*, such as has been spun of unequal thickness. This arises, for example, from differences in weight in the slubbings on the cards or by uneven addition of waste to the separate slubbings, whether of such waste which fell under the cards or gets tangled on the axles of the rollers. The same is true of waste of the slubbing itself, by unequal addition of the spinning waste to the rest of the stuff, whereby, very often, the last layers deliver uneven or weaker yarn.

I call special attention to these admixtures of waste, as it is a very common fault.

Consider first a slubbing, consisting entirely of properly carded wool, and then another containing waste from the same portion of wool, or one which has already passed the carding machine. In the first case the waste is fairly short, and in the second case the material is $3 + 2 = 5$ times carded, and will fall much shorter, so that the resulting threads consist of several thread ends, and so give a duller and weaker yarn. This unequal addition of waste is particularly injurious with mixtures of wool with various long fibres. In carding the working rollers are sometimes provided with chain wheels, often of the same size and the same number of teeth. If in this case the supply of wool to the machine varies, the inequalities remain throughout the material more or less, and the final result is irregular yarn.

Stripes lengthways of the warp may also arise (*a*) if as above stated the working rollers are chain driven, and the

chain is slack. Then the rollers move jerkily, and hence, of course, produce irregular material at the drum; (*b*) by too great oscillation of the fly; (*c*) through uneven action of the carding machine bands, or the presence of old cards if the material is too long for the spacing of the carding bands; (*d*) by too strong or too fine side threads, which result from slubbing and slivers not lying properly on the feed table; (*e*) by not allowing a sufficient interval between carding two differently coloured lots, so that the cards dirty the second piece with hairs and dye from the first; (*f*) by not allowing sufficient interval after cleaning the cards, so that too many hairs catch in the teeth; (*g*) by greasing too much wool at once, so that it dries too much, according to the length of time it is left lying and the temperature of the workroom, by the evaporation of the water in the grease, and the last portions even of the same material will come out heavier than the first because the water lost is replaced by wool; (*h*) if the greased wools lie too long pressed together, so that the oil and water sink into the lower parts of the mass, and make those parts spin finer than the rest; (*i*) if the cards are allowed to get dirty and make the yarn dirty and uneven; (*j*) if the weight on the slubbing is changed in working the same lot, without any notice of this being taken in spinning. Carders are accustomed to do this on the sly, hanging on smaller and smaller weights, to make the work go better and the slubbing thicker. Hence the finished yarn is stronger and the work goes on more conveniently for the spinner. The simplest way of preventing this fraud is for the spinning master to allow the weights only in closable boxes, and if he thinks the carder is making the weights too great, to the detriment of the spinner, to examine them often himself; (*k*) by bad laying on of the slubbing to the second and third machine; (*l*) by fibres running together on the carding machine or the jenny; (*m*) when the count, especially in hank making, is much altered, and the differently spun

yarns are not kept apart; (*n*) if the cops on the self-actor or spinning machine are spun too full. It then often happens that when the carriage runs out one or two windings slip down from the cop, and so push against the last slubbing wound off. With this, the new thread will be made too thick, and also get too much twist, giving a hard thick thread. This most commonly happens where the winding wire is most bent upwards. (*o*) Unequal yarn is also caused by spinning together staples of various lengths. The upper sliver rollers or threads on the condenser come out thicker and stronger than the lower ones; (*p*) uneven yarn is also caused by drawing out too much at the close; (*q*) and also if part of the yarn is spun too fine, so that the yarn comes out faulty, if too thick counts are to be obtained with a single thread. Under defective material or yarn we may include snarled yarn which ought to be smooth. Such snarls are formed in spinning in many ways, the most important of which are the following: (*a*) When as above remarked (see *n*) the cops on the self-actor are spun too full, (*b*) when the winding wire is bent, (*c*) when the spindles stand too slanting, as often happens with worn bearings, (*d*) when one goes on another too early, (*e*) when the opposite winding wire is not pressed down enough as the carriage runs in, (*f*) when the spindle frame stands too deep, or single spindle bearings are worn down, and (*g*) when the carriage forms a bent line, it is very apt to form snarls as it runs in.

4. By defective steaming of the yarn. This does not often happen, but deserves to be mentioned in case that the yarns are steamed for different lengths of time. I know of a particular case in which part of a large lot of yarn was not steamed at all, through the carelessness of the workman. He had been called away from his work, and when he got back the baskets were placed together. He carelessly assumed that his mate had put everything right and let the work proceed. The goods made from that lot of yarn were all streaked

when finished, and with some places tight and other places slack. Decatising them did some good, but did not remedy the matter entirely.

5. Stripes are also caused by exposing the yarn to daylight or the direct rays of the sun. This is specially the case with yarn lying in boxes or baskets. If the dyes are loose to light the upper part of the yarn fades, and hence the groundwork of a stripy piece is provided. The sunlight also acts on yarns when the washing after dyeing has been delayed. If a part of these yarns is dried in the sun and the rest in the shade, the former is more bleached and more sensitive to the dye than the latter.

6. Unevenness and stripes are also caused when yarn from two or more lots of the same colour is used for a warp, *i.e.*, when remnants of a number of lots are warped together, if they are not put together in the right order. If, for example, the warping begins with a fresh yarn, and there are remains of older lots of the same count, but not exactly alike in strength, material and colour, there is great danger that stripes will result, if the positions of the threads concerned are not specially chosen, and adhered to during the weaving. If it is impossible to keep the proportions of 1 to 1, 2 to 1, or 3 to 1, it is better to warp the smaller remnants by themselves, than by having different yarns in different places to get striped goods.

Here I may specially mention melange and double-threaded yarns, with which special care is necessary both for warp and weft. Considering the melange yarns first, we find that they must be compared before making the warp, if it is not too much trouble, and those rejected which differ greatly from the rest. This is specially necessary where warp effects are to be realised on the fabric. It is also very advisable with melange yarns, to warp at the same time from two or more boxes, *i.e.*, in the positions 1 to 1, 2 to 1 (1, 1, 1), or the like. In this way it is easier to get a warp free from stripes than if—as

is usually the case—the spools are taken out of a box, and one thread pieced to another without more ado. If melange yarns, as often happens, are rather uneven, they should be used for the warps of fabrics with few warp effects, and 50 per cent. of them on each side.

With regard to doubled yarn, what has just been said also applies. The most risky doubles are usually the loose-twisted ones, for the following reason : Every practical man knows that yarn can be doubled on an ordinary spool wheel, by winding on so many turns, and in unwinding not letting the spool run “round,” but drawing off from above. The thinner the spool is made the more windings of yarn there are, and each single winding gives a twist as the yarn runs off the spool. With thick spools, the upper windings certainly resemble the winding on the case somewhat, but at the end of the spool no comparison is possible. With loose-twisted yarn, however produced, care must be taken that the spindle cords are equally stretched, that the spindles stand quite vertically, run freely and are well oiled.

In doubling machines only strong spindle bands should be used, as they do not slip so easily. Toothed wheels would be preferable, as they cannot slip, but they make too much noise, unless made of hard leather. If in doubling, a spool has to be unwound on account of a snarl, it is advisable in unwinding to let the spool run “round,” so that no further twisting is caused, but the precaution is not absolutely necessary with hard-twisted doubles. With so-called doubled yarns which consist of two or more different colours, the same precaution is necessary in unwinding, to avoid unequal windings.

Here finally I may mention an occasion on which I was asked why a piece-dyed fabric where the warp was made solely of remnants of various colours came out streaky. On investigation it proved that the various yarns had not been properly mixed in warping and the warper had thought that

everything would be black. Now everybody knows that already dyed material takes up new dye differently, according to its previous colour, and this is why there was every possible shade of black in the finished fabric.

II. UNEVEN WARPING.

This subject has already been rather fully treated in vol. i. of Rieser and Spennrath's *Handbuch der Weberei*, and I shall deal with it here briefly.

Streaks may occur

(a) When in hand warping too thick porties or beers are used, which do not open out easily or uniformly during weaving, so that they get unequal tension and cause loose threads or places.

In hand warping, especially with fine single-coloured goods, the number of threads should not exceed 30 or 40. I have got very good results with very difficult goods, such as satin and corkscrew, by taking for example a 13-inch leaf, so as to have 26 or 39 threads to warp and making the beginning and also the end of a porty always fall on leaves 6 and 7 or 7 and 8. The reason is that every porty gets more or less sharply twisted on the loom, but a porty which is made from above downwards is usually less twisted than one going from below upwards, which is caused by cross seizing by the warper the two neighbouring threads; the last of one porty and the first of the next usually come from another kind of twist of the porty, so that in entering the leash they get somewhat differently stretched. If in addition to this one of the threads is lifted in the harness right behind and the other right in front, unequal stretching of the two threads necessarily occurs. In warping coloured or large-patterned warps, as in striped and square patterns, it is evident that the above numbers must often be exceeded. In this case it is well to divide the porty into bunches as shown in Fig. 6 and in beaming to

put a quarter of a porty between every two teeth of the raddle.

a and *b* are the cross plugs, *c* the half porty going down, and *d* the half porty going up again. I have here purposely left the hinder part of the porty lightly shaded and made the front part black to show the reader. The half porties must here also not be twisted one under the other, so that in a given

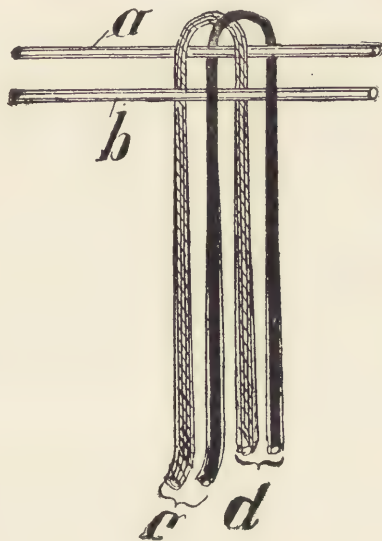


FIG. 6.

pattern, where we piece with only half the threads, we twist the porty intentionally upwards in the great lease. I also refer to the article on warping in vol. i. of the *Handbuch der Weberei*.

(b) If in hand warping too thick warp parts are made which make the porties lying below on the frame come out shorter than the upper ones.

(c) If in hand warping some of the warp threads are held

tighter than others, the result is too long or too tight porties
With very fine-carded yarn goods, as satins, corkscrew,

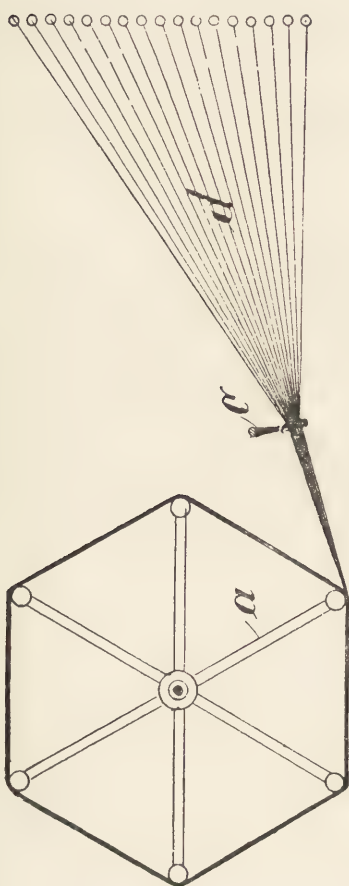


FIG. 7.

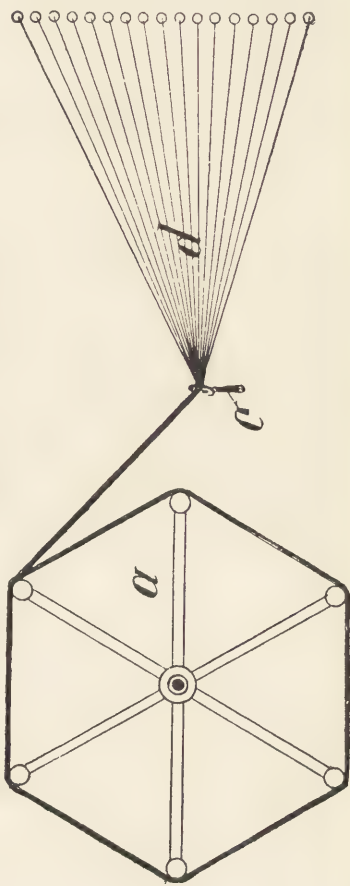


FIG. 8.

etc., especially those in which the warp is predominant on the right side, it is a good plan to warp on a hand frame only with the porty from above downwards or only from below

upwards, for those threads which are warped from above downwards enter into the appearance of the fabric quite differently from those warped in the opposite direction. We trace this difference to the following two causes: (1) The porty or warp hank receives from the turning of the reel from right to left no such strong stretching as if it turned from left to right. Figs. 7 and 8 will show this clearly without further explanation. In Fig. 7 we see the warp threads *d* coming from the spool frame on to the reel *a* unhindered, while in Fig. 8 they are shown doing so with a check at *c*, so that in the latter case they are wound more tightly on the reel.

(2) It is a strong opinion in trade circles that because the yarn in one part of the porty in hand warping is woven in the opposite direction from the other, different appearances to light are thereby produced in the fabric. How far the stretching, especially that of the latter part, and the fine spinning on one-sided yarn act is unknown. In any case an investigation into the matter would well reward the trouble.

(*d*) If we warp the warp with thick or thin spools only. This circumstance is more important than many think. If we first consider the warping going on with full spools, the thread naturally runs off easily under ordinary circumstances, and gets more or less loose. But at the end of the spool, when it stands nearly empty in the frame, the thread runs off with more difficulty, and while doing so gets more twist as mentioned on p. 33, and becomes tighter, especially with thick or loosely twisted doubles. This is the chief reason why streaks lengthways in the warp are so common with loose-twisted doubles. If all the spools are uniform, the whole porty will run tighter off the spools than at first. The warper must always try therefore to warp with unequally running spools, in the positions 1:1 or 1:1:1, or even in four gradations. As a rule, unfortunately, little heed is paid to this.

(*e*) If the warp is warped with somewhat thick warp parts. If the warper winds the new porty sometimes above and

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sometimes at the side of the finished part inequalities may be expected in consequence in the fabric. As above remarked, we should make as small warp parts as possible, and wind the porties as much side by side as possible and not always one over another.

What was said under (d) is not only true for hand warping but for machine warping. To be convinced of the truth of this it is enough to stand behind the warp drum with a ready pieced warp on it. It will strike even a tyro that two or four

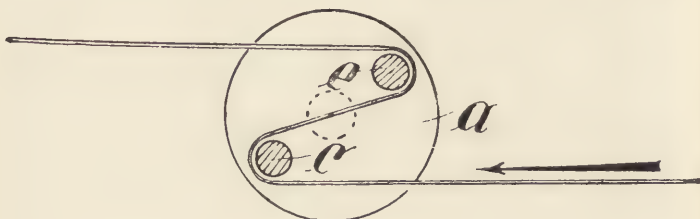


FIG. 9.

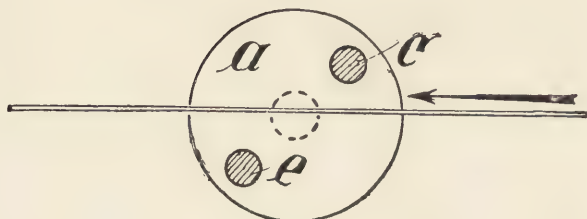


FIG. 10.

depressed places exist on the drum, which feel harder than the rest. What is the reason of this? Simply that where the depressed places are the spools had been wound right out so that the yarn ran out less easily, and caused a tighter thread. The warp from these places will not show so much in the fabric as in those to make which the spools were not exhausted or nearly so. What is the remedy? There are two:—

1. Setting up the spools as shown under (d).

2. Regulating the tension of the thread by the thickness of the spool. This can be done by the drum or the brake rods. These are iron rods between which the threads pass as they leave the warping apparatus. At the beginning of new or thick spools the skewers are so placed that the threads get stretched as in Fig. 9 where the arrow shows the direction in which the thread travels, *a* the drum disc, and *c* and *e* the rods.

As the spools get empty, the disc is gradually moved till at last they stand as shown in Fig. 10.

The apparatus only works satisfactorily when properly used. This is unfortunately rarely the case. Streaks caused by wrong adjustment of the apparatus are easily known, because they take in every time the whole width of a band, *i.e.*, of as many threads as run off from the spools at the same time. In early researches I had had the skewers put in the hand frames so that they could be turned. The warper was then obliged to work with equal spools, and had to alter the position of the skewers as the spools emptied. The plan was all right in theory, but did not turn out well in practice, as the warper too often forgot to alter the skewers. Another way of avoiding the difficulty is to stretch each thread separately, but this is a question which has not yet been properly settled.

(*f*) Streaks with mechanical warping may also result from the spool frames, which are usually set in an opened wing form, being too far from each other in front. This causes those threads which are the furthest out to run in at too sharp an angle as compared with those nearer the middle. Hence the former become tighter than the latter. Repeated investigations have confirmed my opinion only too well.

(*g*) When the division does not correspond exactly in width with the spacing of the warps. Figs. 11 to 13 will explain this matter. Figs. 11 and 12 show the warp drum, and Fig. 13 the dividing reed. In warping machines of old construc-

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tion the threads pass the reed before getting to the drum. The reed can be made wide or narrow according to the warp closeness required, wide for wide-spaced warps and narrow for close-spaced ones. If now the warper does not act conscientiously, and pushes the reed too high, for example, so that the spacing is too close, the band will become too narrow, and will take more or less the form shown in Fig. 11.

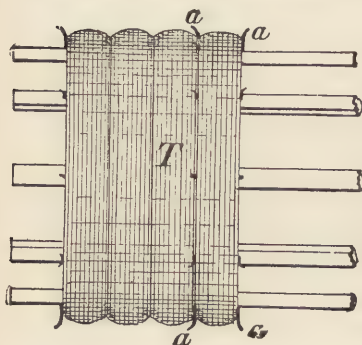


FIG. 11.

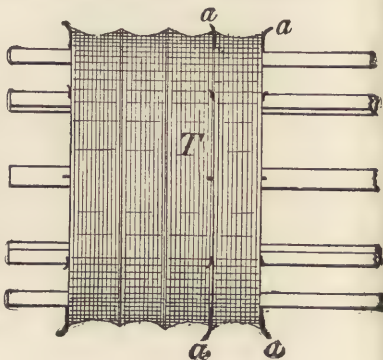


FIG. 12.

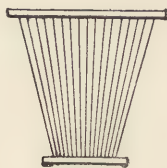


FIG. 13.

We see on the drum T depressions between the points marked *a*. If it is a question of a difficult work, such as piece-dyed worsted, it will be sure to be streaky, and we often see streaks from this cause even in simple goods. If on the other hand the workman pushes the reed too deep, the bands take the shape seen in Fig. 12. In Fig. 11 the bands get too long in the middle, and in Fig. 12 at the side, so the golden mean has to be found.

The diagonal windings introduced a few years ago are always to be preferred to the pegged-in drums, if rightly constructed.

I would here call attention to another bad warping habit, *viz.*, to put every possible lot of yarn on to the machine or warping frame. If several women work side by side, carelessness is sure to result in yarn being taken from the wrong box, and spools which have happened to fall to the ground are put back into the wrong box or basket. Afterwards no one can make out why the goods are streaky, and the spinner is often blamed. The warpers should therefore have no yarn except what they actually want, and should not be allowed to gossip.

III. DEFECTIVE SIZING AND STEAMING OR DRYING OF THE SIZED WARP.

In coloured cotton warps some loose dyes come off after the sizing on to the brushes and the neighbouring threads. This does not occur so much with wool, but there is a risk of having size patches if care is not taken. This happens, for example, when the upper wringing roll of the sizing machine has been lifted for some reason and then the sized warp has been allowed to pass with a part unpressed. The same results if an already sized and dried warp must be turned back into the size bath, and does not get properly softened before it is wrung again. Size patches also result when the size has not been properly purified through a sieve, especially if it is shoe-leather or hide-clipping size.

If the weaver lets such patches get unopened too near the harness, tight threads are formed at first, but after opening the patch they are too loose. Oversized warps are best remedied by drawing them through warm water, or if not much overdone, through weak size, heating them otherwise exactly as in ordinary sizing. If, however, the warp is only slightly

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sized, it is a good plan to spread out a damp cloth near the stretching beam, renewing the moisture from time to time by dipping the cloth in water and wringing it.

Special size patches making the weft show wavy marks result when the pressure roller over the size trough is not properly wrapped. If there are gaps in the wrapping the wringing is, of course, uneven, and imperfect and diagonal size patches are formed.

A good wrapping is got by first wrapping a felt tight round the roller, as is used in card bands, and then several thicknesses of a thin cotton cloth, sewing the thicknesses together with good sewing cotton. Naturally at the beginning of the work this wrapping must be well wetted.

In sizing it is not enough to have the pressing roller properly wrapped. Both it and the under roller must be accurately circular. I may here call attention to the following case in point.

A foreign firm sent me pieces with warp streaks for investigation. The streaks were in pieces with various warps, and occurred most commonly in summer. After long inquiry it was discovered that the under size roller was not true, and had caused unequally sized places, some containing several times as much size as they ought to have done, and had never properly dried, so that they smeared the lower bar of the warping machine. In this way, first the warp could not travel uniformly, and secondly a fermentation was set up in the damp oversized places, whereby the dyes suffered and the milling was rendered defective.

I might here also mention size which has gone sour, which plays an injurious part with some dyes. Hence the addition of boric acid to the size, especially in summer, is advisable as a disinfectant. If the warp is sized too hot with a hand machine, especially if it is not stretched out at once, but left lying piled up, various evils result. The hot size, which is then very fluid, sinks readily to the bottom of the pile, so

that it is oversized and the top undersized. Besides, the colour of the wool suffers by long overheating. Pieces containing oversized warp should be well soaked before going to the washing machine, or else the direct heavy pressure on the sized places (if the goods run in folds) may easily cause kinks or breakages.

IV. DEFECTIVE STRETCHING OF THE WARP.

This is specially important with wool warps warped and sized by hand. These operations are superficially done in many factories, especially when the drying-room is not so long as the warp, so that the stretched warp has to be moved backwards and forwards. Then special care is required to give a uniform stretching throughout. Every master weaver especially concerned should make a point of visiting the drying-room as often as possible to see personally that this is done. Many factories have a good custom of marking all warps off into lengths of about 5 metres by a coloured thread or a paint-mark. This makes it easy for the sizer to stretch uniformly.

To-day, when competition is so keen and only faultless goods can be profitably sold, no trouble must be shirked, and the greatest attention paid even to the most trifling operations. To prevent the warp from sticking to the rollers at either side of the drying-room and to avoid size patches the sizer must at the beginning of the drying turn the rollers a little at intervals of half an hour or an hour. In drying on the reel size patches are formed on the rods according to the structure of the reel. This can be remedied by putting in round rods instead of the ordinary square ones, and turning them a little at intervals of half an hour or an hour. As to softening the size patches I refer to the last chapter.

Streaks also occur in warps which contain loose dyes and have been dried in the sun or the open air. Those threads

which lie on the surface are more attacked by the light than the rest. Hence with certain awkward dyes the warps should not be dried in the open air, at least not in direct sunlight. As regards insufficient drying, refer to the remarks on "mildew spots".

V. DEFECTIVE BEAMING OF THE WARP.

This is a great cause of streaks lengthways of the warp, and the following circumstances, among others, are concerned in it:—

- (a) Defective fastening of the warp to the yarn beam.
- (b) Unsuitable raddling.
- (c) Laying the warp too narrow or too wide in the raddle.
- (d) Too thick porties.
- (e) Too loose or unequal beaming.
- (f) Too tight stretching in beaming.

(a) *Defective fastening to the yarn beam.* Many weavers are careless in fastening the warp to the yarn beam. The porties must first be uniformly spaced on the beaming stick. Then, holding the stick with one hand, strike the porties with the other, whereby the half porties are equalised on either side. Then the stick is exactly parallel to the beam, and if, as is necessary, there is a groove in the beam, fasten on so that the stick lies exactly in the proper groove. If the stick is not bound exactly parallel to the beam, diagonal streaks appear at every revolution of the beam. The cords with which the stick is tied must not be too thick, and thick knots must not be made, or the warp gets too tightly wrapped over the cords or knots, and makes loose places in the weaving.

For fastening the warps on to the beam it is best to use a piece of strong linen into the end of which a flat iron bar is sewn. The stick in the warp is with the prepared warp fastened at intervals of from 15 to 20 cm. by fine but strong

strings to the bar in the linen. Of late I have been using more than one flat bar, uniting them in S-shaped hooks.

To be extra careful with special goods, a sheet of pasteboard should be inserted in the binding. It is still more convenient, however, to sew a flounce on to the linen which will cover the knots. This flounce does not wear out like pasteboard.

(b) *Unsuitable Raddling*.—Raddling is defective when the number of teeth does not correspond to the number of porties, *i.e.*, when the number of teeth is not great enough for every space to contain the same number of threads. Hence every manufacturer, now that no good adjustable raddle is on the market, has to have as many different sizes in stock as possible. If, for example, gaps must be left in beaming in order to get the right breadth of the warp, it is obvious that the part of the beam opposite these gaps is less strongly fastened than the rest. If the beam is very thick, the porties wrapped on it near these places sink in, and towards the end of the weaving of the warp become too tight, making places too loose at first and too tight later, and thus always causing streaks.

If we take the opposite case, *i.e.*, certain of the spaces between the raddle teeth containing more threads than others, because we are compelled here and there to put doubled porties in a space, the beam gets too tightly wound at those places, and becomes thicker there, wherefore the warp is stretched at those places more than elsewhere, and streaks are the necessary consequence.

Both cases, too wide as well as too narrow raddling, are not so bad if the warp, on leaving the raddles, passes under and over a few stretching bars, whereby the gaps and differences in thickness are to some extent done away with. It is also advisable to change about the raddle often from right to left and *vice versa*. This helps the effect of the stretching bars. Nevertheless we must always try for porties as thin

as possible, and as many raddle teeth as porties. Raddles of delta shape, which may be made large or small, are to be recommended. See under (d) below.

(c) *Too Wide or Narrow Beaming*.—I do not assert that too wide or too narrow beaming actually produces stripes, but I have the case in my mind that the position of the beam plate does not correspond to the breadth of the warp in the raddle. If, for example, the warp is wider than the distance between the ends of the beam, and there the threads often tear during beaming. The heaping of the warp at the ends of the beam makes unequal stretching of the threads, and hence produces streaks at the edges of the piece. If this excess of width in the warp is noticed too late, the raddles are put askew so as to get the proper width, and kept so till the beaming is finished. If the reverse is the case, *i.e.*, the warp is narrower than the beam length, it is more serious, for places are produced at the sides of the piece where the side threads are depressed during beaming and especially during weaving. If this is noticed in time, the beam is shortened, but if a good deal of warp has already been beamed, it is taken off again, and the beam then shortened. The disc ends adjustable by screws and described by me on p. 985 of the *Handbuch der Weberei* are highly to be recommended. If they are used, unbeaming is rarely necessary, if the use of the screws is not put off too late.

I wish to call special attention here to the fact that if the width of the warp is only a few centimetres out, it is better to leave things as they are, as a few centimetres more or less do no harm. See the article on too loose beaming.

(d) *Too Thick Porties*.—Refer back to p. 36, *re* the warping of thick porties. Thick porties lay the foundation of an uneven fabric, because, during weaving, if they are a little distorted, they open badly, and also do not lie smooth on the yarn beam. Thick porties also cause faults by making ribs on the beam, if the raddle was not moved backwards and

forwards enough during beaming. This backward and forward movement of the raddle is absolutely indispensable in hand beaming. If then the party comes between two of

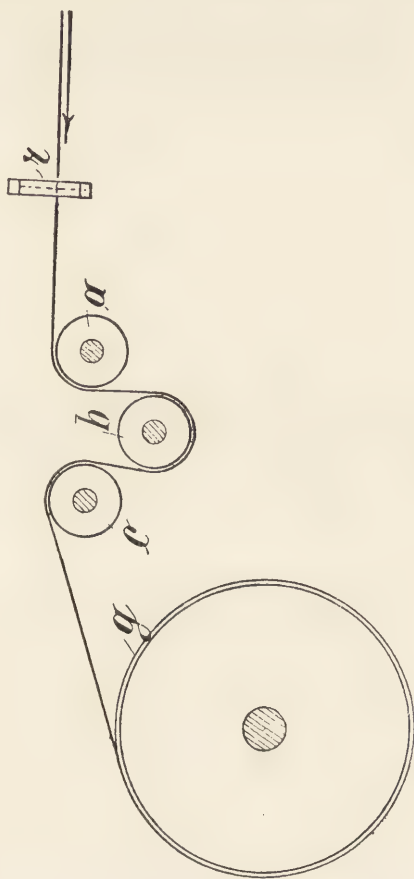


FIG. 14.

these ribs, it becomes looser. Here, as in all warp beaming, the warp should be passed under and over several stretching bars as is almost always done. The arrangement is shown

in Fig. 14. In England, strange to say, beaming machines are still made without this indispensable adjunct. In our figure *r* is the raddle, *a*, *b* and *c* stretching rods, *b* being as a rule adjustable higher or lower, and *g* the beam. Rotatable stretching rods may be used for any required tension.

(e) *Too Loose Beaming*.—This causes streaks lengthways of the warp just like unequal beaming. If the warp is beamed

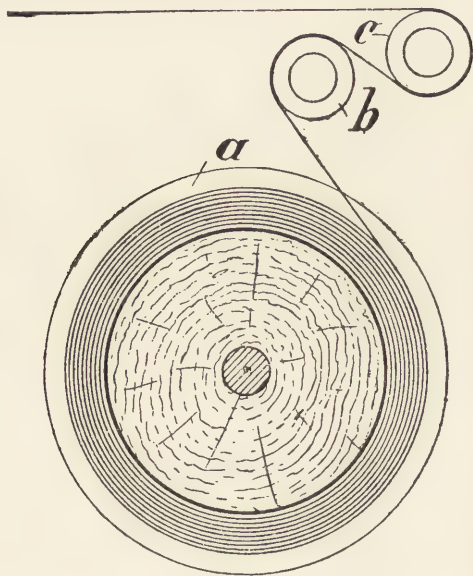


FIG. 15.

too loose, we must not shirk the trouble of unbeaming it and rebeaming it properly. It is in all cases better to do this than to run the risk of spoiling one or more pieces, which happens very easily when the porties are unequally loose and give too loose and too tight places in weaving. The distorted patterns which often come upon the market are nearly always referable to too loose beaming. In the same way, many

carded wool goods with heavy warps get streaks lengthways. Such warps do not beam on so strongly as worsted warps.

If we find that the weaving shows too loose beaming the remedy is to add more stretching bars. Then the stroke of the batten does not act so powerfully on the loose warp. Figs. 15 and 16 show two different systems of stretching bars.

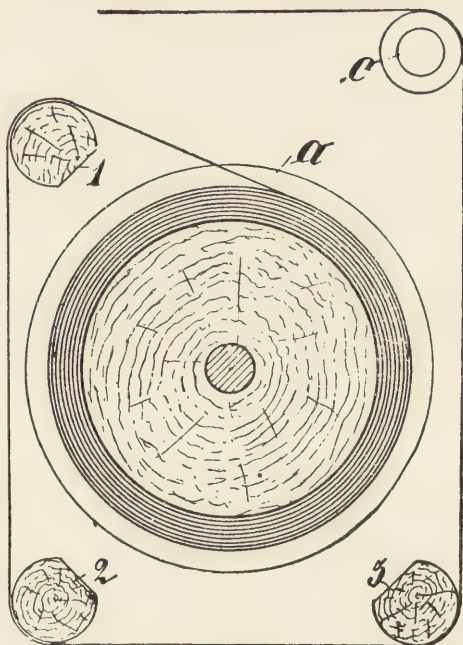


FIG. 16.

a is the yarn beam, *b*, *c*, 1, 2 and 3 the stretching bars. The arrangement shown in Fig. 15 has given me very good results in practice and is easily made.

(*f*) *Too Short Stretches in Beaming.*—This only applies to warps warped with a hand machine. With heavy warps, either of strong yarns or of very numerous threads, loose

porties are easily caused by too short stretches. With long stretches, however, the porties usually equalise themselves.

VI. DEFECTIVE TWISTING OF THE PORTIES IN TYING ON.

If the warp consists of an upper and an under warp and the porties are not uniformly twisted, so that in one porty the upper warp and in another the under warp is beamed upwards, the action of the less twisted porties is irregular, especially in smooth single-coloured goods. Porties in which the warp does not open easily show differently in the fabric from those with a clear opening.

What has just been said about beaming also applies to the case of the weaver from any cause bringing porties into the wrong grooves. These porties do not open easily.

VII. WRONG TREATMENT OF THE WARP ON THE LOOM.

Here the following points are to be considered:—

- (a) The separation of the porties.
- (b) Piecing the threads during weaving.
- (c) The substitution of threads.
- (d) The nature of the breast beam.
- (e) The treatment of rods.
- (f) Wrong sizing or greasing of the warp.
- (g) The rubbing of anything against the finished cloth on the loom.

(a) *The Separation of the Porties.*—This only applies to hand-made warps. In separating twisted porties or porties stuck together by size special care is needed. If they are allowed to get too near to the harness before being separated tightness of threads, or even whole porties, ensues, and then slackness after separation. In the first case the warp penetrates the fabric too deeply, and in the second the reverse is the case. If the weaver has tangled or untwisted porties, or porties stuck together by size, in his warp, he must proceed

with great caution. With an untwisted porty, a round skewer or weight is hung in it and it is carefully watched. The same is done with stuck and tangled porties.

(b) *Tangling during Weaving*.—This is usually done by apprentices and careless weavers, who in piecing a broken thread, or bringing a thread into the harness, do not see whether it is snarled with its neighbours behind the harness or not. Such snarling give single or grouped overtight threads in the fabric. See last chapter.

(c) *Substitution of Threads*.—If, for example, a thread breaks and the weaver cannot at once find the end, or a lot of a thread is missing, the weaver is compelled to replace it. The substituted threads are inserted into the warp in four different ways as follows: (1) By putting a spool, in the neighbourhood of the stretching bar, over the loom or under it, winding the thread from the spool a few times round the yarn beam, and then putting it through the harness with the others. This method is only practised when a great length of thread will probably be required. (2) By twining fragments and threads near the yarn beam round the porty in which the thread is missing. I may here mention a bad habit of many weavers of fastening the substituted thread to the yarn beam when it is necessary to loosen the porty from the beam with one hand in doing it. This does no harm as a rule with ordinary goods, but much with fine goods, and especially when the warp has been beamed a little too loose, because then the threads get loose for a moment. (3) By the weaver tying any object to the threads concerned, and letting it hang down behind the stretching bar. See under "tight threads". (4) By the weaver leading threads from some other part of the warp to the defective place.

All four methods are good if executed with the necessary care and skill. In the second the same precaution is wanted as with untwisted porties, *i.e.*, not to substitute too near the harness, for then the porty prevented from rising gives too

tight threads, and after the substituted threads have come to end, places which are too loose.

(d) *The Nature of the Breast Beam.*—Many loom makers do not pay sufficient attention to this important matter. In many looms the screw and nail heads project too much. Although these are not always injurious to the goods they are sometimes, as dirt collects behind them, especially in wet weaving. This dirt gets wet and soft. When the loom stands still on Sundays and holidays the dirt, which usually contains size, dries again, and when work is resumed abrades the fabric. Hence all nail and screw holes should be counter-sunk. Rough breast beams, especially of iron, scratch the goods, if woven with the right side down and weighted here and there by laying a shuttle on it.

(e) *Treatment of Rods.*—If rods are to be inserted into the warp or left there during weaving the greatest care must be taken, especially with fine single-coloured goods, because then streaks through tight porties or single threads easily happen, as here and there groups do not open properly. The rods act on these and also on the threads of the leaves behind, because these receive a higher and deeper shed, with such tension that they stretch them too tight. It is a very good plan never to tie the rods to the stretching bar, but to weight them with a small weight which yields correspondingly if a thread gets tangled. The best advice, however, is to dispense with rods as much as possible.

Thirty or forty years ago it was supposed that weaving without cross frame rods was impossible. Now in the wool trade they are hardly ever used.

(f) *Bad Sizing or Greasing on the Loom.*—As a rule only linen or cotton warps are sized, but they, as well as silk and wool warps, are greased with paraffin or unsalted lard, but wool is also greased with oleine or olive oil. There are weavers who have the bad habit of making strokes with the brushes in sizing from the yarn beam to the harness, causing

loose threads. This is specially injurious for fabrics with a warp effect, as every loose place shows clearly in the fabric.

(g) *Rubbing Against the Finished Goods on the Loom.* See article xiii., also p. 54.

VIII. IN CERTAIN GOODS EXCESSIVE NUMBER OF HEALD SHAFTS OR SETTING THE HARNESS TOO WIDE.

In difficult goods, those for example with a dark weft and a light warp, or *vice versâ*, or where the pattern offers a rather smooth surface, such as some simple cheviots, streaks may easily be caused by using too many shafts. This is easily understood, because the threads in the leash raised by the hinder healds do not make exactly the same angle as the forward ones, *i.e.*, are not lifted so clean and tight. In the silk trade such faults are also easily caused by setting the harness too wide, and especially if the Jacquard is provided with lifting mechanism only. If large numbers of shafts or broad harness setting cannot be avoided for rather smooth goods, it is well to have a special arrangement of threads. For example with thirty-two shafts draw the first thread on to No. 1, the second on to No. 17, the third on to No. 2, the fourth on to No. 18, and so on, or group the threads in three or four divisions. With a deep-set harness the same order is available. In the wool trade the harness board is of far less importance than with silk, where it is indispensable for many patterns.

With unusually fine croise, which is worked with very thick laths in the harness, and with which the shafts stand rather far apart in the loom, it is also well to rearrange the threads, for example, to make a 1, 2, 3, 4. This makes a better and clearer result. Of course the lifting of the shafts must correspond to the entering.

IX. DEFECTIVE HARNESS.

Here there are many causes of streaks lengthways in the warp.

(a) When the tringle eyes are such that the threads catch in them. Refer here to "too tight threads". If the eyes turn, the threads get snarled round them. In both cases the thread gets rubbed, which spoils its lustre, and makes it rough, a thing very injurious in silk and in very fine worsteds.

(b) When the harness consists of wire healds which are not properly spaced, or are rough, as is often the case with turned healds. If the healds are too close together in places, they rub the threads and roughen them, in rising and falling. In coloured wools this matters less, but with piece-dyed worsteds the rubbed places appear later darker than the rest.

(c) When harness is used with unequal shafts or healds. This alone does not matter much, if, when the harness is hung up, attention is paid to the depth of the separate healds. If this is not done, and the heald shafts are all hung up at the same height irrespective of depth so that some of them have their eyes lower than others, streaks are sure to occur, especially when there are many shafts or the patterns are large. This may be caused in two ways: either the threads hanging too low are roughened by rubbing on the weft board, or if they go into the upper leash, they are not lifted high enough so that they do not admit the weft in places, do not lie so smooth as the others which have been properly lifted, and do not go properly into the upper leash until the shuttle passes. Healds hanging too high are more easily noticed by the weaver from the higher lifting of the threads, and so rectified.

(d) By allowing too large groups of empty healds to hang in the harness. The warp threads which come into contact with these groups, and must rise and fall close to them, get

rubbed and rough and cause streaks in the finer goods. Besides, the outer threads on both sides of the gaps exert a drag on the reed sticks, which yield a little, and so by making the warp rough, again produce streaks.

X. UNEVEN OR DEFECTIVE REEDS.

The reed is one of the most important parts of a loom. Threads drawn through an uneven reed give uneven and therefore streaky goods. The unevenness of the reeds may be the fault of the maker, but may also arise during the work. If the matter cannot be fully remedied, the whole reed should be thrown away. It is better to waste a few shillings than to get streaky goods. Rusty reeds are also injurious, because they not only dirty the goods but also roughen the threads. In both ways the subsequent dyeing is spoiled by dark places appearing. These places are removed as shown in the last chapter. A reed can also be defective by containing reeds which are too thick or too thin. If too thick they rub the warp, and prevent a proper opening of the shed, while if too thin, they easily give sideways, and so cause streaky goods.

XI. IRREGULAR REEDING.

Here the following are the chief points to be considered:—

(a) When the reeding has been unskilfully done, so that the threads are not combined properly.

(b) When the weaver puts the threads in the wrong places in piecing or in threading, so that some reed openings contain more threads than they ought.

(c) When the groups of threads are so reeded that the goods become streaky, whether lengthways or diagonally.

(d) When the groups of threads are too large.

We will give an example of (a). Suppose a pattern of four dark and two light threads, and the threads reeded so that the light threads are separated at one place and together at

another. We then get two different sorts of stripes. And this simple effect may be repeated over and over again throughout the width of the warp.

(b) is so simple that it requires no illustration. After the weaving is finished, it can be remedied by bringing the pieces over a perch, and removing the superfluous threads from the wrong side with a needle.

(c) is only too common in practice. As an example we may take say a 9-leaved cross weaving, with four threads per reed, and find that every $9 \times 4 = 36$ threads have the same ratio, *i.e.*, that for every nine reed openings the same spacing and weft arrangement recur. Every expert knows that such unsuitable ratios cause in any single-coloured fabric a false twill effect. It is not a lengthways but a diagonal streak. With the number 9 the evil can be simply remedied by taking 3, an aliquot part of 9, threads to the reed. With prime numbers, such as 7, 11, 13, 17, etc., as few threads should be taken per reed as possible, so as not to make the whole ratio too large, for the larger it is, the more risk there is of a false twill effect.

(d) If we take too large groups of threads per reed, the opening does not take place properly, and the threads in the middle of the bundle being pressed together, a separation of group from group takes place at the sides, making the fabric ribbed.

XII. WRONG WEAVE OR COLOUR POSITION.

Refer to Chapters IV. and VIII.

XIII. WRONG TREATMENT IN REMOVING KNOTS (BURLS).

Many readers may think it impossible that streaks should be caused by this, but they very often are. The burler pulls the knot out of the goods and then tears or cuts it off. The pulling out makes a tight place right and left. To prevent

this, the burling iron is passed backwards and forwards a few times over these places. If the iron is ever so slightly sharp at the edges it makes defective places, which in worsted and lusted cheviots are very detrimental. These streaky places are recognised by tapering off in two directions, as the scratching takes place in two directions. These scratches are also often caused by the point of the iron, but may also be produced by needles or shears.

XIV. WRONG TREATMENT IN WASHING, MILLING AND CARBONISATION.

Refer to Chapters XIV. and XV.

XV. WRONG TREATMENT IN RAISING.

Streaks may be produced at the end or beginning of the piece in raising by sewing on with too long stitches, so that the stretching of the cloth and hence the pressing on the raising cylinder is unequal. Also if the goods touch the raising teeth more on one side than the other, which happens when the guiding rollers are not properly placed. Raising streaks occur also very easily if the goods are stretched too tight during the raising. Another cause of raising streaks is when the cards of the gig are of unequal strength, whereby the cloth is naturally unequally affected. This inequality in the carding may be of three kinds: the cards may be unequal in strength or thickness, or be unequally worn, or have gaps in them.

In choosing cards it is very advisable to employ a skilled person. It is better to pay a specialist a little more than to entrust the selection even to the best workman. Most old raisers only examine the cards superficially, and are not competent to choose. In large manufacturing towns there are usually specialists who go from factory to factory, and carry out the setting of the cards.

I would here call attention to the changing of whole card-rods. With a careless raiser, the cards are often put too close together, and then changed. This does not cause streaks lengthways, but shade effects transversely which do not agree together.

Raising streaks also occur if the goods are not uniformly wetted, as when it has hung over a horse so that the water has accumulated in the selvages, and they are wetter than the middle.

Also if the goods are not kept carefully at full width, and pass the gig in a creased form. Seams are very apt to form these creases.

Also if the goods are raised when too dry. The effect of this is particularly injurious on indigo-blue riding cords. It does not follow that riding cords must be raised extra wet, but moderately wet and uniformly so. Above all things, at the beginning of the raising, we must use very worn sets of small cards, and gradually substitute better and sharper ones. We must also reverse the direction of the raising occasionally, so as to avoid, or at least lessen, streakiness, which once produced is very hard to get rid of. Pieces with raising streaks, especially in indigo-blue, look as if the colour had been rubbed off in places, but they can often be made faultless by again subjecting them to the gig, and constantly reversing the motion of the piece. If, however, this does not succeed, the piece must be lightly milled and then again raised. If pieces of doeskin, etc., which require heavy milling, come from the milling with milling creases, the creases are removed by soaking in warm water and wrapping round rollers before the piece is raised.

It is evident that too projecting cards may cause streaks or even holes.

Raising streaks always run lengthways and never diagonally, unless the goods have been pulled too much backwards and forwards.

Most raising stripes can be removed by a careful second raising, or they can be removed with the steam brush, and if the streaks are very bad, re-raising in a very wet state. It is also a very good plan to wet the piece well, and then to stretch it in every direction on a drying frame. It is then again wetted, wrapped round a roller, and left to stand for a time. It is finally raised over again. Goods striped in raising can also be rectified by a careful treatment on the roll-raising machine followed by a fresh raising. Fabrics with very hard yarns such as mohair and many lustred cheviots will under no circumstances raise well, and the result is very bad in most cases.

XVI. WRONG POSITION OR UNEQUAL SHARPNESS OF THE SHEARING KNIVES.

Unequal shearing may occur

1. By unequal placing of the knives.
2. By unequal sharpness of the knives.
3. By unequal dampness of the pieces. This often occurs because the parts in contact with the drying frame do not get quite dry, and damp cloth does not cut so easily as dry.
4. By unequal oiling of the spike leather.
5. By unequal hardness of the lower knife.
6. By unequal position of the shearing bench.

XVII. IMPROPER ROLLER PRESSING.

Streaks of the worst kind may result from roller pressing

1. If the right side of the goods is uppermost during the pressing, the pressing roller is not wrapped with felt, and the iron is somewhat porous. If the pressure is heavy, the smooth roller slips on the smooth surface of eskimos and similar fabrics, and the small porous places make nasty scratches. These can only be removed by thorough washing followed by raising.

2. When there are furrows in the roller or trough, and they come into contact with the right side of the cloth. Furrows arise in the trough when the roller is not coated with felt, and in the following two cases: (*a*) when narrow patterns are being pressed and these go through at the ends and not at the middle of the roller. The roller then presses at the ends, where there is no cloth, so strongly upon the

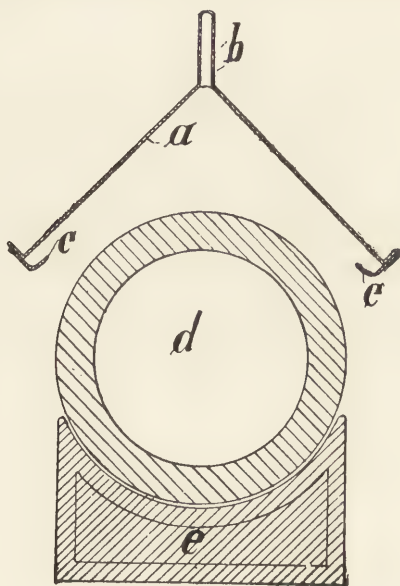


FIG. 17.

trough that with the least porosity of the metal, they begin to grind each other; (*b*) if hard particles, such as bits of lime from the roof, get into the trough, as happens but too often. To prevent this falling of mortar from the roof I have constructed the shield shown in Fig. 17, where *e* is the trough, *d* the roller, and *a* the roof-like shield pierced with a few air holes. To prevent water condensed on the under side of

the shield from dropping on the goods, the gutters *c* are provided, and the turned-up edges of the shield prevent fragments falling on the shield from above from reaching the fabric.

Refer also to rubbing and creases resulting from roller pressing.

XVIII. STREAKS IN WORSTED DRAPÉS.

This style is very difficult to make, and many manufacturers never succeed perfectly, and turn it out as if it were sewn over with countless small streaks, and looking as if it had been scratched all over. The following are the principal causes of these streaks :—

1. If the warp is placed too light.
2. If the fabric contains too much weft.
3. If it has been too quickly and too strongly milled in the breadth.
4. If it has been raised with too stiff cards.

Nos. 2 and 3 are the most common. The method of rectification is as follows: If the fabric has been already decatized, it is carefully softened by boiling in a proper machine, and then carefully milled in a quick milling machine. It is then washed, heated from 10 to 15 minutes at 50° C., wrapped on rollers and left there to cool. Then it is raised, and if need be re-dyed, and finally finished.

In milling drapés, sewing the goods into a pack should be avoided whenever possible, or the felting cannot be uniform. It is better to stretch out the fabric frequently, for the result will well repay the trouble taken.

TRANSVERSE STREAKS.

These arise from the following causes :—

1. Uneven yarn.
2. Unequal damping of the weft.

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3. After pirning of wetted weft yarn.
4. Unequal damping of the warp during weaving.
5. Improper picking of the weft.
6. False weave and colour position.
7. The weft running badly off the pirns.
8. The loom standing still a long time during damp weaving.
9. Improper use of the yarn-beam brake and the cloth beam.
10. Improper nature of parts of the loom, *e.g.*, when beams and stretching rods are not truly circular.
11. Loom running without weft.
12. Mistakes in finding lost picks.
13. Too close warp spacing.
14. Unequal warp stretching in hand looms.
15. In hand looms, by uneven hanging or motion of the batten.
16. Uneven progress or wrong position of the temples.
17. Unequal stretching of the selvages.
18. Too great differences in the weft material.
19. Improper taking out of burls.
20. Drying goods in the sun.
21. Too long lying of the goods with acid, especially if exposed to air and sun.
22. Improper treatment of cross streaks in raising.
23. Hanging the goods improperly in the carbonising drying-room.
24. Wrong position of folds in decatizing.
25. False position or unequal sharpness of the knives in the cross-cutting machine.
26. Wrong position of the press plates in hydraulic pressures.
27. Long lying damp of the goods before cutting.

I. UNEVEN YARN.

Here what was said on p. 30 with reference to the production of warp streaks in this way also applies. As various yarns must be inserted in proper order in the warp, so they must be picked in the weft. It is often advisable to weave a lot of old yarn before beginning with the new work, provided we have not to do with old yarn which is itself uneven.

If on the other hand no new piece is to be begun when a residue of yarn has been woven up, it is well when a new work is begun to weave up a few pirns of the old lot with those of the new, first in the proportion of two to one, then one to one, and finally one to two, or the like for the sake of the finishing. In this way much streaking at the places of transition is avoided, an important matter with regard to raising and shearing.

Many streaks are also avoided by the spinning master giving the weaving master a proper report of the first products of a spinning, where two or more different thicknesses of yarn have been produced by the count not coming out right. If the weaving master knows this he can underpick this lot in proper proportion with another yarn.

In melanges and doubles, under picking, *i.e.*, using several shuttles, is indispensable for one and the same sort of yarn. I refer to what I have already said on melanges and doubles for warps. They require not less than three shuttles, and care must be taken that they are not going at the same time. In carders' doubling it often happens that untwisted pieces of thread are included, which show dark in the finished piece.

Now that the mechanical arrangements of the loom are practically perfect, even with single-coloured goods, we should work with two if not three shuttles, with the above precaution against them running together, as the piece is then much more uniform. See also under 5.

Cross streaks also result from pirns being wrongly wound, too light or too thick. This is a very frequent cause. Three remedies are to be highly recommended :—

(a) Let the weaver examine every pirn before he puts it into the shuttle, and reject those of wrong material or thickness.

(b) Use several shuttles for the same weft as already insisted on, especially with melanges, doubles, single-coloured over weft and thick under weft. The thicker the yarn the more irregular it is as a rule, and the more it must be used for under weft.

(c) This, which is not very easy, consists in removing and not avoiding the streaks. This is done after washing or milling and before raising, and succeeds fairly well. I refer here to those cross streaks which form wrinkles. Cut a more or less wide strip pointed at both ends at the places concerned, near the selvedge, and sew the selvedge carefully on again. Success is in many cases perfect if this is carefully done, but it must be executed before raising, and these places must be carefully kept at full width during the raising. I know a case of cross streaks in a dyed piece caused by mildewed wet yarn.

II. UNEQUAL DAMPING OR STEAMING OF THE WEFT.

This often causes cross streaks. If the pirns are not completely wetted through and not uniformly centrifuged, or wet pirns are left lying too long unused, the yarn is thrown unequally spaced and the streaks are thereby caused. I refer here to an article in the *Handbuch der Weberei* on yarn wetting. Above all things wet pirns must not lie long heaped up, or the pirns get unequally wet by the water gravitating to the lower pirns. The triangular heap piled up by old weavers for draining the pirns must on no account be permitted with difficult work, because the upper pirns generally get nearly dry, while the lower ones dry much less. To some extent

this can be avoided by covering the lower pirns with waste to soak up the water coming from the upper ones.

As to defective steaming I first refer to p. 43, *re* defective warp steaming. The process is more difficult with weft yarn. If it is left to the weaver he generally steams too long or too little, and often forgets to do it at all or omits it purposely. I have known cases in which the weaver put his pirns in the steam chest, turned on the steam, and went to his work and forgot all about them, so that they got three or four times as much steaming as they ought to have done. The work should be entrusted as a special duty to a conscientious man.

III. SPOOLING OF WET YARN.

One might think this had nothing to do with cross streaks, but it may cause them, and streaks of the worst kind, and especially, as experience has shown, when the yarn has been wound under tension by a machine.

On p. 820 of the *Handbuch der Weberei* it is mentioned that a woollen thread of 560 yards per oz., soaked with water, had an average elasticity coefficient of 42.8 per cent. Consider now this wet yarn being wound stretched by a machine or mixed with ordinary unstretched yarn. The combination of stretched and unstretched yarn will form cross streaks. The matter will be worse the longer the stretched yarn is left before being woven. Wet yarn should never be spooled on a machine if for use in weaving.

I should like here to call attention to the picking of old wet pirns which have been lying. Carded yarn especially, from its content of oil, gets sticky by long lying wet, so that it does not run from the shuttle so freely or so uniformly as other yarn, so that it must be used cautiously. It is very important not to wet more pirns than are required for immediate use. Very sticky yarn is best put with the waste.

IV. UNEQUAL DAMPING OF THE WARP.

In damp weaving the passage of the wet weft damps the warp, and the capillarity of the warp threads makes the water penetrate far beyond the point of contact of warp and weft. The warp is always somewhat damp, therefore, while the loom is at work, but dries in the night and on off days, unless the weaving shed is very cold. It is therefore usual on beginning work to damp the warp at the throwing place. But this is not always done with sufficient care, and so much water is often thrown on that the place becomes thoroughly soaked. This easily causes a double trouble, one being to make the warp take up too much weft at once, and the other that the goods get felted at the wet place. If a white fabric is being woven, which has to be dyed later, the felted place appears darker. I must here state openly that I do not favour wet weaving, which causes all sorts of cross streaks, as well as every possible sort of mildew and rust stains. The warp should not be too heavily sized, and as much weft as possible should be inserted. It is better to get the necessary weight by a longer washing or milling.

In damping the pirns a little boric acid should be added to the water, at least in summer, to prevent mildew.

The best vessels in which to wet the pirns are scoured wooden or enamelled pails. How often do we get rust stains after the pirns have been a long time in water in badly tinned iron pails? I know a case in which silk doubles so treated would not dye properly, and came out too dark. See Chapter XV.

V. IMPROPER UNDERPICKING OF THE WEFT.

I remarked on pages 65 and 66 that even with single-coloured weft several shuttles should be used, whereby greater uniformity is secured. Further, that we should work with 1:1 or 1:1:1, *i.e.*, three shuttles. But this proportion is by

no means invariable, but should sometimes be discarded, as is shown in Figs. 18 to 21.

In all the figures we have 9-leaved diagonal ribs in the weft effect, as shown in Fig. 18, by the two sorts of type. In Fig. 19 we have the position 1:1 with two shuttles.

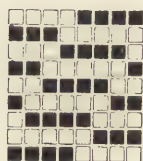


FIG. 18.

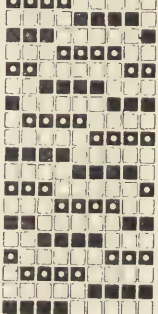
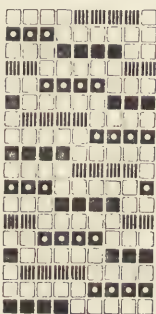
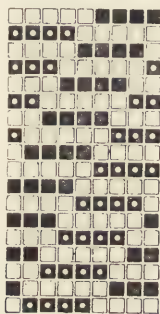
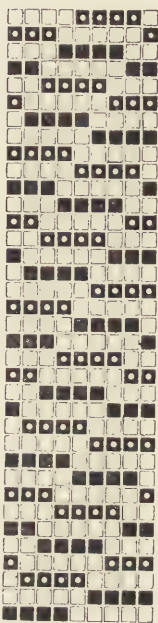


FIG. 19.

FIG. 20.

FIG. 21.

Imagine for a moment that the two wefts are of unequal strength, *i.e.*, the odd numbered threads too thick, and the even numbered ones thinner; we then get an unequal twilling, coarse and fine. Hence the proportion 1:1 must not be used. In Fig. 20 we have three shuttles, 1:1:1. This will also not do. If the black types represent the thicker threads, we get a contrary twill, as is easily seen in the figure. The

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proper twill of the whole weft runs to the right and the grouping of the black types runs to the left. If we then look at Fig. 21 we find a distinctly better arrangement, with the position 2:2, and get in every direction of the weft the position 1:1.

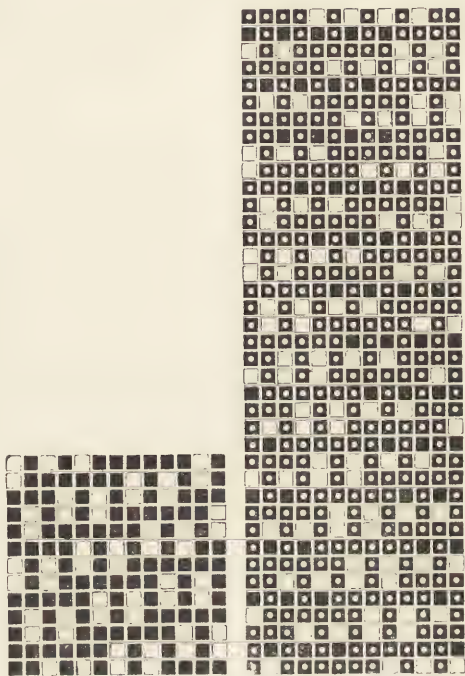


FIG. 22.

FIG. 23.

If we turn now to Figs. 22 and 23 we recognise in the former the well-known 13-leaved corkscrew. For the sake of brevity we will choose only the proportion 2:1 in the weft, and also in Fig. 23, as shown by the arrangement of the black types. If it now happens that the third weft is

much thicker than the other two, or much finer, we get a reverse twill, as shown in Fig. 23. The proportion 1:1 is also not faultless, but we get a better result with four pirns in the position 1:1:1:1 or 2:2.

If, on the other hand, we have to deal with a simple smooth fabric, position 2:2 is evidently wrong, and only the proportions 1:1 or 1:1:1 are advisable. What has here been said about the position 2:2 is specially applicable to thick under weft. If the yarns are unequal, two thick wefts show against two finer ones in an otherwise smooth fabric. With thick under weft these should be done with two shuttles only, in the proportion 1:1, or the inequalities will be too perceptible.

VI. WRONG POSITION OF COLOURS IN RELATION TO WEAVE.

After referring the reader to p. 27, *re weave*, I may mention that for certain purposes, *e.g.*, with single-coloured goods or with certain colour positions, a weave may be all right which would give cross streaks with other colour positions.

Take Fig. 24 as an example. We have there a double cloth, in which the under-warp threads 1 and 3 bind the two fabrics together, No. 1 uniting with the first upper weft and No. 3 with the third lower weft. If we wished to make a pattern with this weave, which should form squares in longitudinal and cross stripes, the goods with this weave would come out with cross streaks, for the following reasons. Take for example that the right side is arranged

1 light }
1 dark } 4x
1 dark

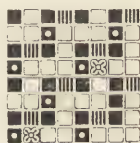


FIG. 24.

and the weft put in in the same way.

The first upper weft would be 1 light. This weft would by Fig. 24 be connected to the under warp, would be covered

by three-eighths of the whole warp, and would also be drawn more into the interior of the cloth by the under warp. This happens alternately according to our colour position 4x. Now two dark weft threads come in succession, so that the fifth light weft will fall on our third weft. Here only two threads, *i.e.*, only upper warp, are lifted, so here the light weft thread 1 is only covered by two-eighths of the whole warp, and 2 is no longer drawn inwards. It will therefore show much more than in the first case. This is repeated for every 4x, which causes a light cross streak in the fabric. This evil is avoided

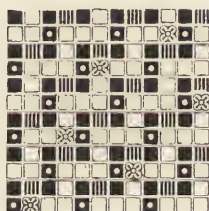


FIG. 25.

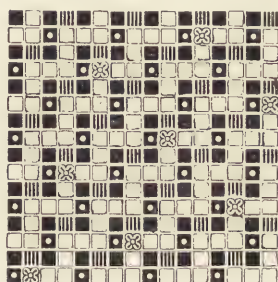


FIG. 26.

if we use Figs. 25 or 26, where every under warp thread and every over weft is connected.

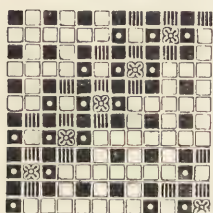


FIG. 27.

In Figs. 25 and 26 every over weft is connected, in 6-atlas form in Fig. 25 and 8-atlas form in Fig. 26.

Take as a second example Fig. 27, and as intended as a weave for an overcoat-
ing with a coloured wrong side. The combination of the wrong side took place, as can be easily seen, with the under warp over the upper weft. We draw the under warp through these points of connection to the

middle of the fabric, and allow the under weft to cross regularly only with the under warp. The coloured warp threads which are in the under warp to form the squares will thus naturally not show so much as the coloured weft threads. If we give a little nap to the wrong side by raising, the result will be still worse, as the weft is, through its loose twist, and also through its being, on account of crossing the fabric, more acted on by the cards than the warp is. We get better results with Fig. 28 or 29. In the first connection is made between over warp and under weft, in the other between over warp and under warp. Fig. 28 is therefore to be recommended if the coloured back weft is loosely twisted and

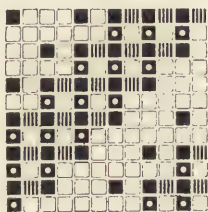


FIG. 28.

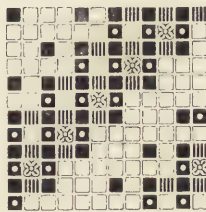


FIG. 29.

somewhat raised. For very soft goods we could only connect half as much, *i.e.*, in 12-atlas fashion. Of course then the weave must be twice as high and twice as wide. We may also make the under warp with longer floats so as to make it show more. But the affair is so simple that I think I need not discuss it further.

What has been said happens only too often with other colour positions, and chiefly when in many-coloured goods one or other colour of the weft is too much covered by the same colour in the warp. If the colour positions tend to make streaks lengthways of the warp, that rarely makes the cloth useless for men's garments, but the case is very different, and the goods are spoiled if the streaks are produced crossways.

Figs. 24 and 27 would have been perfectly right for all single-coloured goods and in some cases for those of more than one colour. The cross weaving is only unsuitable for particular colour positions.

It may happen for various reasons that a weave necessarily causes cross streaks, as in the case of improper combinations of warp and weft effects in the same weave and improper combinations of weave themselves correct.

To adduce an example of the first kind will be unnecessary, but one of the second is shown in Figs. 30 to 32.



FIG. 30.

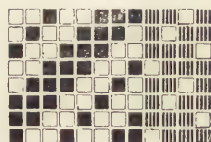


FIG. 31.

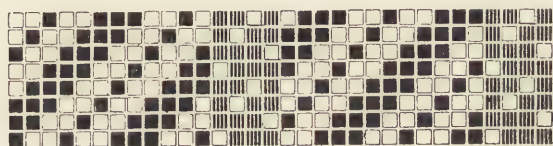


FIG. 32.

In Fig. 30 the first 12 warp threads in 8-leaved twill and the last 4 threads in 4-leaved twill produce the warp effect. If we consider the 12 threads, we find for the first weft thread 6 warp threads, and the same for the second.

On the 3rd weft thread 7 warp threads; on the 4th weft thread 7 warp threads; on the 5th weft thread 6 warp threads; on the 6th weft thread 6 warp threads; on the 7th weft thread 5 warp threads; on the 8th weft thread 5 warp threads, lifted up. Hence we get an unequal combination

of warp and weft effect, consisting of light and shade in single-coloured goods, and if there is any distinct difference in colour between warp and weft an enhanced contrast between them.

In our figure we have below on the first 12 warp threads 2 warp effects, and only 1 above. This can, however, be easily remedied by reducing the number of threads in the twill to 8, as shown in Fig. 31, or by doubling the number of 8 and altering the weave of Fig. 30, as shown in Fig. 32, whereby also the trouble may be more or less avoided. What has here been said of a small pattern naturally applies with greater force to larger surfaces.

When the motions of the loom are not properly executed, false weaves and also cross stripes may result. See p. 27.

I cannot here refrain from speaking of the too rapid motion introduced into mechanical looms some years ago. Something, of course, can be said for getting the greatest possible amount of weft in in the shortest time, but caution in this direction is necessary. Faults would be spared if the looms worked more slowly. It is a question not only of the machine working accurately at the highest possible speed, but also whether the weaver can under those circumstances properly control the use of the material and the complexity of the pattern. The faults caused by too rapid working may more than make up for the supposed gain by increasing the expense for fine drawing and by producing faulty fabrics.

VII. UNEVEN UNWINDING OF THE PIRNS.

If the yarn is not uniformly wound or the pirn is too big it lies squeezed in the shuttle, or if it is too long for the shuttle, and if the upper part of the shuttle is not smooth, it is easy to get tight weft, and hence cross streaks. See p. 24.

VIII. TOO LONG STANDING OF THE LOOM IN WET WEAVING. See pp. 66 and 68.

IX. IMPROPER USE OF THE YARN BEAM BRAKE AND THE CLOTH BEAM.

All brakes of whatever kind must be always kept dry and clean. By carelessly pouring oil on the bearing near the brakes it may get on or between the brakes and cause uneven action. Brakes with hemp ropes too are not entirely trustworthy, as they act differently with every change in the weather and in the amount of moisture in the air. How many weavers and cleaners are there not who in cleaning the shed carelessly throw water under the loom and on to the brakes. This rusts them and makes them work unevenly.

The weaving master has also to take care that no felt is missing from the brake band, and that no fastenings stick out.

The cross streaks, caused by defective braking, are usually easily recognised by recurring with every revolution of the beam, and hence at fairly regular intervals.

With all yarn and cloth beam regulators care must be taken that all motions can act at once, even with the smallest difference. In weaving with two yarn beams cross streaks also readily happen if the two beams do not work regularly together.

X. UNROUND YARN OR CLOTH BEAM, OR BREAST BEAM AND BACK ROLLER.

The cause of streaks is often looked for in the wrong place. In fine difficult goods it is as well, when certain cross streaks occur, to examine the breast and back beams. Consider, for example, a loom not yet old with a warp on the beam and tightly stretched standing for a long time idle. The warp exerts a tension on every part of it and in one direction, often bending parts. This often happens to wooden breast and back beams.

If the yarn beam is not truly placed or if its ends lie rather near the loom bar below or to the back roller above, it easily happens that the beam cannot turn freely, and then cross streaks result. A short time ago I had to examine a cross-streaked fabric, in which the streaks recurred at short and almost regular intervals. On examining the loom I found the back roller had been bent 5·7 mm. Looms near heating arrangements are specially exposed to this danger.

XI. TOO SLOW WEFT PIECING, TOO MUCH LOOSE WEAVING, OR THE LOOM RUNNING EMPTY TOO LONG.

If the weft is broken, a pirn exhausted, or some fault has to be rectified in the weave, much breakage or wrong picking, or any other thing, the weaver must weave back a part of the fabric, or finally the loom runs for a time without receiving any weft. In all these cases gaps are formed, great or small, according to whether a brake or a regulator is used. In most cases the cloth beam is loose and the yarn beam is turned back as far as possible, and great care has to be taken about the renewal of the picking to remedy one side or the other of the cloth. This back weaving also causes dull places by rubbing the warp threads.

XII. MISTAKES IN FINDING LOST PICKS.

These cause hundreds of small cross streaks, and in many cases the defects are not noticed till after the finishing. This often happens with double fabrics, where the two sides are connected in one way or another. Take Fig. 33 as an example. Suppose that the first four weft threads are in. Then the weft breaks, and the weaver gets hold of No. 12, which corresponds exactly with No. 4, and calmly continues the work. Instead of No. 5 following, where the connection is made with under-warp thread No. 6, No. 13 comes, where connection is made with under-warp thread No. 2. Hence in

two contiguous over weft threads two points of union come close together, one on weft thread No. 3 and the other on No. 13, so that there is no defect in the fabric, but there is in the position of the points of connection. Such a fault only shows plainly after washing or milling. The weaver ought to have controlled not only the under but the upper weft. Such cases occur in countless numbers.

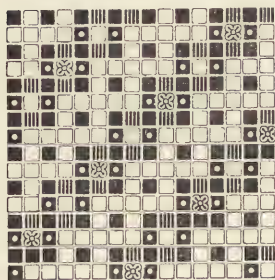


FIG. 33.

XIII. TOO THICK SPACING OF THE WARP.

In atlas and such fabrics as show much warp effect, and are spaced very close, it often happens that the goods show small cross stripes, and occur every time the weaves come into connection. Those weaving masters who are making the style for the first time think that the fault is with the cards, and seek for it in vain.

To explain the matter we will choose a 5-leaved atlas as shown in Fig. 34. In this fabric there are five threads to a reed. Every No. 1 and No. 5 is laid to the reed stick, whereby they open more easily in the shed, because the motion of the reed separates the two from each other. Nos. 2, 3 and 4 are everywhere within the two sides, and No. 3 is the one which is shut in most, as two contiguous threads press on it on each side. In 5-leaved atlas it is thus always the middle thread that causes cross streaks. In this special case I have got better results when I altered the weave as shown in Fig. 35. In Fig. 34 it is obviously the hinder leaf which causes the fault.



FIG. 34.



FIG. 35.

Now the further the middle thread is from the reed the

less it is lifted. Hence Fig. 35 gives a better result, because the erring thread is lifted nearer the reed. Another remedy is to have this leaf lifted rather higher, and to work, as already said, with a tightly stretched warp.

It is also as well with this sort of goods with very close warp to have very small teeth on the cloth beam regulator, so that the cloth is wound on regularly and not jerkily, as it is with coarse teeth.

XIV. UNEVEN STRETCHING OF THE WARP IN HAND LOOMS.

Uneven warp stretching happens most often with hand looms, especially when a regulator is not used.

The hand loom is almost obsolete for ordinary goods, but I cannot refrain from saying a little about it. In hand weaving the weaver is compelled alternately to let warp off the yarn beam and to wind up the finished fabric on the cloth beam. If he does not stretch the warp the same every time, streaks are certain, for the more strongly stretched warp takes more weft than that which is less tight. In the first case the weft shows more, in the second the warp. Many styles, especially with light warp and dark weft or *vice versa*, in which at the same time small patterns have to be made, *e.g.*, cloth weaves, mat or panama fabrics, 3- or 4-leaved twill, small granites or the like can scarcely be produced of uniform texture with hand looms, especially with wet weaving.

Formerly wet weaving on hand looms was a fertile source of bent cloth beams. If the damp fabric remains a long time on the beam, it wets it, especially if it is made of soft wood. Then if the loom stands empty a day or two the beam dries and warps.

XV. UNEVEN HANGING OF THE BATTEN OR UNEQUAL MOTION OF IT IN HAND LOOMS.

It does not require many words to show that if the batten does not stand at an angle to the loom, or the latter does not

stand at the right angle, the goods cannot come out right. In the last article I spoke of unequal motion of the batten in regard to a different stretching of the warp. An important point, too, is that the weaver, if no regulator is used, does not let warp off often enough, *i.e.*, weaves off a lot of fabric without winding any more warp off the yard beam. At first, just after he has wound off, the stroke of the batten is much longer and stronger than later on, so that the goods decrease in weight up to the next winding off. Hence in hand weaving let off warp often a little at a time.

XVI. UNEQUAL MOTION OR POSITION OF THE TEMPLES.

This usually only happens with temples of laths or rods which must be moved from time to time. If the temple is too far from the batten it is obvious that the weft threads will be differently arranged than when the fabric is held at full width near the reed, with its selvages supported by the temple. The proper distance from the reed is 25 to 50 mm. and it is moved right and left alternately. The temple itself must not be too wide, or there is danger of tearing off the selvages, except in very strong stuff, and must not be too narrow, or its oblique motion rubs the selvages and the warp near them, and often breaks them. According as the temple is wide or narrow the warp takes up more or less weft, whereby a fabric of uneven weight is caused.

XVII. UNEQUAL STRETCHING OF THE SELVEDGES.

This has been partly discussed in talking of defective warp beaming. I will here only call attention to the carelessness with which weights are hung on the selvages. There are weavers who, to get a tight selvedge, and to save the trouble of preparing them, hang on them weights which are decidedly too heavy. Not only do the hooks with which they hang the weights on tear holes, but the weights gradually sink to the

floor, or catch under the loom. If this passes unnoticed, little short "corners" or cross streaks appear at the selvages. All these remarks are true of selvages which were woven in afterwards in a second weaving, as was once always done. If the weaver is forced to hang a weight to the selvedge he should use a double hook, as shown in Fig. 36. This does not easily tear the selvedge, because two places carry better than one.

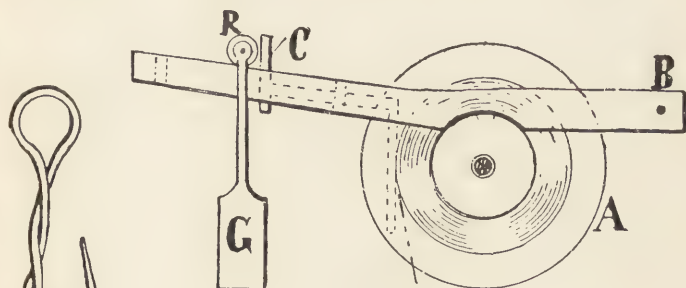


FIG. 37.

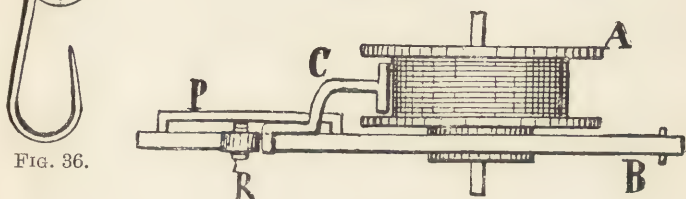


FIG. 38.

To avoid hanging on weights when the selvages are woven separately, I have made a little apparatus, shown in Figs. 37 and 38.

Fig. 37 is a side elevation, Fig. 38 a bird's-eye view. In both figures A is a wooden roller about 12 cm. long and 10 cm. in diameter, with discs 25 cm. high. A is provided with a brake B turning about a point at B to check its movement. To the left it forms an inclined plane, on which rests the

roller R in a bearing (Fig. 37). As the action of the inclined plane makes R press steadily on the guide C, which is in contact with A, R will move towards B as the selvedge is wound off A. The brake will act less strongly in the same proportion as the lever arm supporting the weight. G shortens as R moves to the right. From A the selvedge threads pass down under the yarn beam or only the stretching bar, and reach the harness in the usual way. See chapter on defective selvedges.

XVIII. VARIOUS MATERIAL IN THE WEFT.

Here the two following cases are the most important :—

1. Two very different materials for the right side.
2. Two inharmonious materials for right and wrong side.

Under No. 1, I understand cases where, for example, in large checks or in covers and similar articles a more or less wide-dyed piece is woven and then another strip of a material which behaves very differently in washing and milling.

By No. 2, I understand cases where the upper and under weft materials do not harmonise, or where the latter are of different kinds. This often causes streaky or defective goods. See p. 74.

XIX. WRONG TAKING OUT OF BURLS.

See p. 58 *re* the same with regard to lengthways streaks.

XX. DRYING GOODS IN THE SUN.

First refer to the article on stains caused by drying. If cross streaks appear after dyeing in a fabric which has been exposed when white to the sun, the streaks are darker than the rest, but in soured goods they are lighter. Goods dried in the sun dye darker than those dyed under cover. If a white fabric stays a certain time spread out on a bright summer day, and therefore also exposed to the air, streaks appear which show after dyeing.

XXI. TOO LONG LYING OF SOURED GOODS.

Refer to article on stains from carbonisation.

XXII. IMPROPER RAISING.

If a fabric which shows cross streaks when it leaves the loom is raised as if it were right it is made worse, as the gig acts differently on the streaks. Some improvement is often effected by inserting stretching sticks at those places.

XXIII. WRONG HANGING IN THE CARBONISING DRYING-ROOM.

See article on stains from carbonisation.

XXIV. WRONG PLATE DECATISING.

Although this sort of decatizing is nearly given up, I must refer to cross streaks which it may cause. It is easy with this decatizing process to decatize places, according to the way in which the goods are folded, twice as much as others, and besides wrong folding prevents many places from being reached by the steam. Roller decatizing of course prevents cross streaks. To prevent dull places from decatizing, care is required that the goods are well dried before decatizing. This prevents the fault and also makes the goods softer. It will have struck many manufacturers that in decatizing say eight pieces, one or two of them often show this defect, while the others contain no dull places. This shows that the fault lies neither with the apparatus nor with the steam, and only with the amount of moisture in the separate pieces. The following case taught me this: A piece was hung up loose before decatizing because it was too damp, and got drier above than below as it hung. It was then decatized, and showed afterwards that the part which had dried best had no dull marks at the selvedge, while at the other selvedge, which had been below when the piece was hung up, they occurred

here and there. Care must also be taken, especially in winter, that pieces do not lie for days together before decatizing. If possible they should never be kept in a heated or damp room, as they rapidly absorb moisture and cannot be dry enough to decatise, and condense far too much of the steam used in that process.

XXV. FALSE POSITION OR UNEQUAL SHARPNESS OF THE KNIVES IN THE CROSS-CUTTING MACHINE.

This hardly needs explanation, as it is clear that if the knife is not equally sharp all over, or stands unequally near to the goods, cross streaks must result.

XXVI. FALSE POSITION OF THE PRESS PLATES IN HYDRAULIC PRESSES.

If, for example, for rather stiff goods, eskimo or the like, the plates are wrongly placed and can move sideways, the sharp edges, especially with new plates, press into the fabric and make it look as if the weft was defective. An expert easily recognises these marks, which are usually cross streaks, by their gradually fading away towards one side or the other. The evil is not remedied by getting the first fold in the middle of the press plate, and if it appears after a second pressing, even the sharpest decatizing will not remove it. As most of these press creases occur at the ends of the piece, where the press plates can most easily move sideways, dry ironing is very useful in getting rid of them. It is much to be recommended that pieces with many press creases should be pressed again with a roller press before decatizing. This is the plan that gives the best results. The best modern hydraulic presses, where the goods are pressed at full width, prevent these creases in a great measure, as lateral movement is less likely. These presses have the further advantage that they give a much more uniform effect.

XXVII. GOODS LYING DAMP A LONG TIME
BEFORE CUTTING.

If a damp piece lies a long time folded up, the hairs stand up in the fold, and we get, after cutting, cross streaks, as the upright hairs are shorn closer than the others.

DIAGONAL STREAKS.

There are five causes of these, as follows:—

1. Unsuitable raw material.
2. Unsuitable yarn twisting.
3. Unsuitable weaving.
4. Unsuitable colour position.
5. Unsuitable finishing.

I. UNSUITABLE RAW MATERIAL.

If, for example, we use in double fabrics different materials for the two sides, *i.e.*, materials which behave differently in washing and milling, and care is not taken in combining and crossings and taking proper proportions, the result is uneven on the right side. This happens especially when the material enters the wrong side too quickly, and crosses with too long bare spaces.

II. UNSUITABLE YARN TWISTING.

I refer first to the article on irregular goods, and then proceed to mention some quite special appearances occurring in smooth double fabrics. If, for example, we choose for eskimo and certain corkscrews a different count for under weft than for upper weft, and the goods are only slightly milled, the surface will be less smooth than if both had been twisted the same way. In entering the fabric, too, the two wefts act oppositely on each other. Inequalities also result if either weft is twisted much too loose.

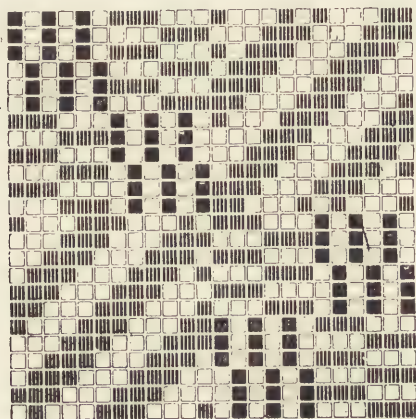


FIG. 39.

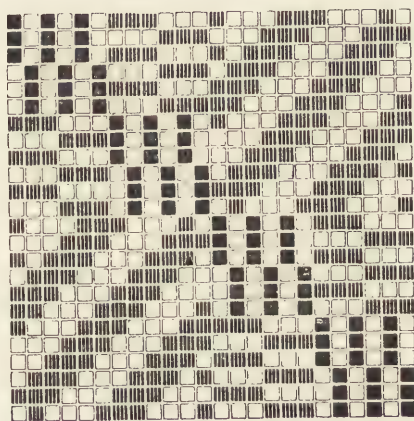


FIG. 40.

III. UNSUITABLE WEAVING.

Here we have streaks from

(a) Wrong threading of the healds. See Chapter II., 11 c.

(b) Improper connection of the under warp or under weft or both to the upper fabric, and so often causing reverse twilling.

(c) False grouping of weaves. The last happens readily in interrupted twills, atlas-like compositions and sometimes in checks. The first two are so simple that no explanation is needed, but the third is illustrated by Fig. 39, where we have in two over-cross quarters 6-leaved twill, and in the other two quarters ribs of three, again in checks.

Even a tyro will be struck with the disagreeable appearance of the ribs in the figure. If, however, we arrange as shown in Fig. 40 the diagonal effect is removed.

If we desire, for example, to remove the continuous effect in 6-leaved twill, it is easily done by letting the upper twill quarter run to the right in the opposite direction.

IV. UNSUITABLE COLOUR POSITION.

This happens when the arrangement of the warp, the picking of the weft, or both, are such that certain single-coloured

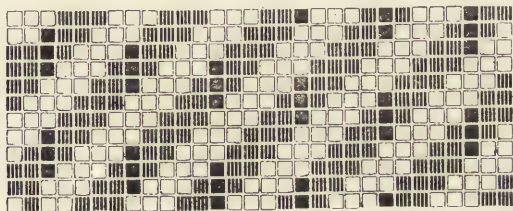


FIG. 41.

threads or groups of them form unwished-for diagonal effects. Fig. 41 shows a small simple example of this. The fabric is

6-leaved cashmere twill, the arrangement of the warp is regular, $4:1 = 5$ threads altogether. This pattern or colour ratio is hence only one thread smaller than the weave. Hence the colour effect varies for each colour ratio by only one weft thread, so we use the colour ratio six times before we begin the series afresh, and so get an ugly diagonal effect. If, on the other hand, we arrange the warp $3:1$, as in Fig. 42, the effect is better and not so loud, as the colour ratio goes out already at 12 threads. If we arrange the warp $2:1$, as in Fig. 43, the cross weaving and colour ratios run out together at six.

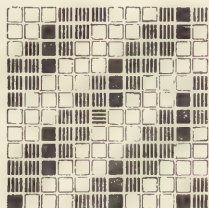


FIG. 42.

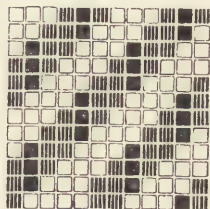


FIG. 43.

What has been here said for small effects applies also to large ones. Care should be taken that the two numbers differ more from each other, especially if scattered effects are wanted.

V. UNSUITABLE FINISHING.

Here I understand all streaks which run in every possible direction, and with every possible width, whether folds or stains. They may result from the removal of burls, from washing, carbonisation, neutralising, milling or drying. See Chapters IX., XIV. and XV.

CHAPTER X.

IMPERFECTIONS OF THE EDGES.

HERE I first refer to Chapter VII., *re* double wefts and snarls, and also to Chapter XI. By edges I mean that part of the fabric next to the selvages.

Imperfect edges may be caused

I. BY DEFECTIVE WARP BEAMING.

I.e., if the warp is beamed too tight or too loose or is heaped up at the ends of the beam.

II. BY UNEQUAL MOTION OF THE TEMPLE. See p. 80.

III. BY DEFECTIVE SELVEDGES.

Refer to "unequal stretching of selvages" and to Chapter XI.

IV. BY A DEFECTIVE TEMPLE.

Refer to the article "Breithalter" in the *Handbuch der Weberei*, to which I will add that a good temple must (*a*) seize the selvages only and not reach into the fabric, or it easily injures the edges; (*b*) accommodate itself as much as possible to the swinging of the fabric so as not to damage the selvages; (*c*) in wet weaving be made of brass, as iron ones easily cause rust stains; (*d*) have straight and not, as too often happens, bent teeth. If the temple reaches into the fabric and has bent teeth they catch and tear the weft and sometimes the warp as well. It sometimes happens that

the pulleys of roller temples get clogged with dirt and cannot turn. Then again the fabric is torn. It may also happen that axles, bearings or casings of a temple are constructed so that they rub the goods and damage or destroy them.

There is only one reliable remedy for bent teeth and clogged pulleys, and that is examination of the temple by the master every time a new warp is started. I have repeatedly seen pieces injured by roller temples with bent teeth, which had to be sold at a loss of one to two shillings per yard.

V. BY FALSE POSITION OF THE TEMPLE.

If it is too high, it lifts the side threads too high, and these threads are easily shot from the shuttles. If it is too low threads which ought to be in the upper leash are easily overshot.

VI. BY THREAD BREAKAGES.

Careless weavers often let threads near the selvages go. They always say that one thread makes no difference there. This was true formerly, but now goods which show breakages at the selvages are invariably pronounced defective.

VII. BY WRONG ADJUSTMENT OF THE PATTERNS TO THE SELVEDGE.

I mean here such larger patterns, stripes or checks which have different selvages on one side and the other, which compels the tailor to cut off a strip to get the seams of a pair of trousers right, for example.

VIII. BY OVERSTRETCHING THE WEFT IN THE SHUTTLE.

This chiefly occurs with goods only supplied sparingly with selvedge threads. There are actually manufacturing towns where the selvages are made 4 to 5 mm. wide only. They ought to be at least 15 mm. It is not wise to lower the cost of production by diminishing the number of selvedge threads. The idea is to save a farthing or two a yard, but

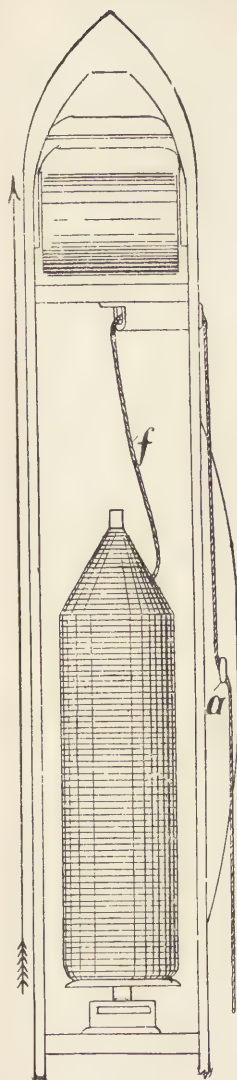


FIG. 44.

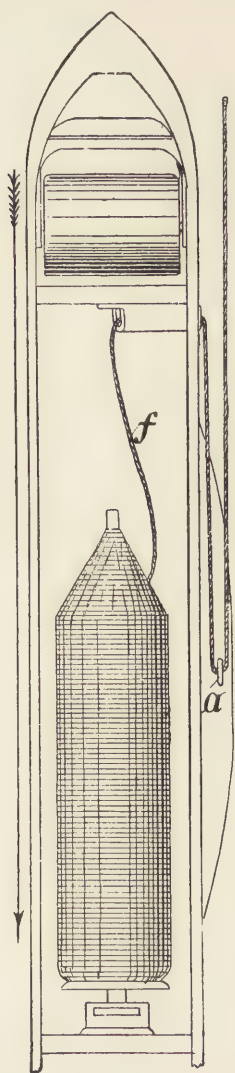


FIG. 45.

people forget that in the first place all elegance is taken from the sides of the piece, and secondly that danger is run of injuring the edges in washing and still more in milling. If rather strong weft is used, or the pirns are badly wound, or catch the shuttle, or if the weaver winds the pirns too tightly, weak selvages cannot stand the pull of the weft, and are drawn closer together, the outer threads becoming too tight. The result is that in washing or milling these selvages not only curl up but form diagonal creases reaching from 5 to 10 cm. into the fabric. Such goods cannot be properly stretched out in washing and milling, and the creases are formed even if the selvages are sewn together. These results occur most commonly in fabrics of cheviot and cross-bred yarn. The weft forms snarls along these creases, which can hardly be remedied. If the goods are shorn afterwards, the snarls are cut away, and the result is dark diagonal streaks on the wrong side, while the crease is on the other side.

This special mischief generally occurs on that side of the loom where the weft is most stretched, particularly if the weft does not leave the shuttle direct from the hook, as Figs. 44 and 45 will show.

In Fig. 44 the thread *f*, as it leaves the shuttle, passes through the ring *a* and goes in the direction of the arrow without further crossing. In Fig. 45 it also goes through *a*, but because it is running to the other side, turns sharply on itself as shown by the arrow. In the latter case the tension of the weft is naturally greater, so that the right-hand side of the fabric will suffer the most. In both figures the weft passes through *a*. This does not happen so often now as it used to do, and weavers try all sorts of tricks when the weft runs too freely from the pirn, and hence often serious faults in the goods.

IX. IMPROPER MAKING OF SELVEDGES.

This has an unfavourable effect on the edges, in so far as it makes them easily curl up in washing and milling and get creased. This improper selvedge making may be due to one-sided weaves, too close spacing, inharmonious material or too long floats. These can be discussed together, and it may be asserted that for selvedge weaves of goods to be heavily milled or washed hard we should take weaves as short as possible like cloth, ribs in the warp of two or even matted weaves; also make the selvedge as loose as possible and of a material which contracts less in milling than the rest of the fabric, rather than of one which felts too much. The selvedges should never be less than 15 mm. wide, to prevent fear of curling up. Slack selvedges are not so bad as tight ones. If, for example, a piece with tight selvedges has to be shorn, the fabric easily swells up near the selvedges and is very likely to be damaged by the shears. In goods in which knots are to be formed during milling, with a suitable wool material, great care must be particularly taken with the selvedges. If they are tight the knotting never takes place properly at the sides. In such cases a strong cotton selvedge must be used or one of a sufficient length.

Refer also to Chapter XI. and article 1143 in vol. i. of the *Handbuch der Weberei* and the account of selvedges in vol. iii. of the same work.

X. KNOTTING OF WEFT THREADS.

This occurs when more than one shuttle is used and the thread of one knots with that of another between selvedge and shuttle box. This makes bad edges by one weft thread being drawn in with the other into the fabric. See p. 24.

XI. PLACING PACKING UNDER SLACK EDGES ON THE CLOTH BEAM.

If the sides of the fabric or warp are somewhat loose, weavers usually pack the goods on the cloth beam in the

most senseless fashion. They do not consider that for every revolution of the beam the packing acts over again, so that the tension gradually gets as much too great as it was before too small.

XII. WRONG TREATMENT IN CARBONISATION, DYEING, DECATISING AND PRESSING.

With regard to carbonisation the following faults may be noted :—

1. Hanging the soured and insufficiently centrifuged goods on horses, when the acid gravitates into the selvages.

2. If, for example, the selvages are of cotton doubles, and these are to be protected from carbonisation by neutralisation. If this is carelessly done, so that some of the piece besides the selvages is neutralised, the dye will behave differently to that part of the piece. As a rule the selvages are painted with a paste of china clay and solution of carbonate of soda. If the paste is made too thin it will spread to the fabric. Of late silicate of soda has also been used for neutralising selvages.

For other faults see chapter on creases and stains. I may close this chapter with a word on plate decatizing. In this species of the process the goods are so folded that the selvedge in each fold lies near that of the fold below, as far as the fourth or sixth fold from the bottom according to whether the selvages are stronger or weaker. From them the position of the selvedge is brought forwards, then inwards, and so on. In all cases this gives marked imprints in the edges, which, however, if care and skill are used do no harm. Better results are got, however, by laying selvedge on selvedge and binding them together with hooks which remain during the decatizing.

CHAPTER XI.

BAD SELVEDGES.

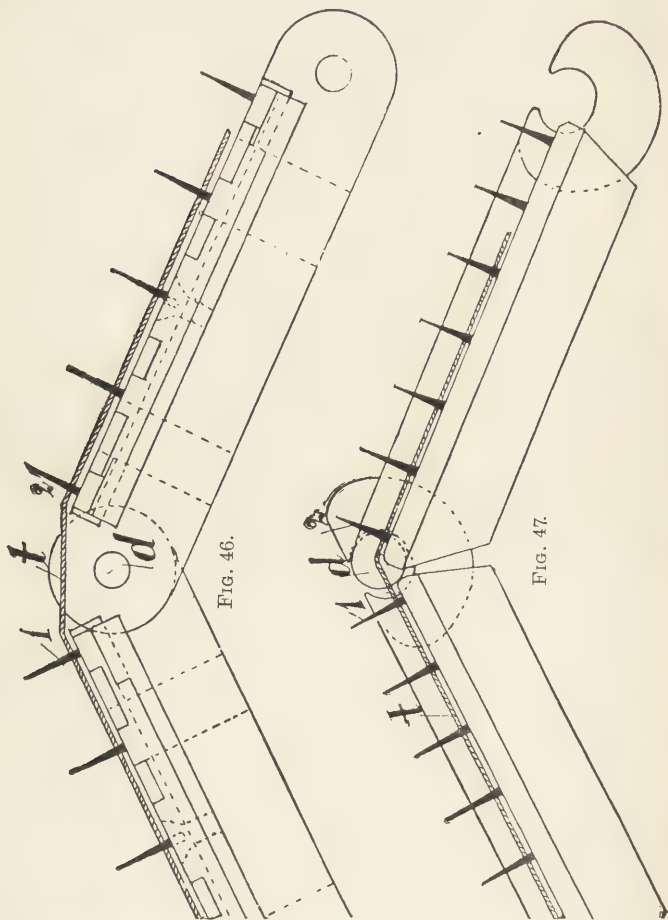
FIRST refer to p. 80. Many factories pay too little attention to selvedges. An otherwise well-made piece with torn or irregular selvedges offensive to the eye cannot be sold like one with a good selvedge. As every one in the trade knows, in certain factories, which only make high class goods, double selvedges have been for some years put on each side of the piece, *viz.*, a real selvedge and an ornamental one. The latter is usually of several colours, and is allowed to remain, the other being outside and being finally removed. This use of double selvedges is condemned as extravagant by many short-sighted manufacturers, but a piece with a beautiful and perfect selvedge is more easily sold than one without it. There are makers who only use old scraps of yarn of all sorts of colours for selvedges, while it would be better to work these fragments up into shoddy, or to use them for cleaning than to spoil goods with them. We sometimes, too, find selvedges with very conspicuous threads only occurring here and there.

I refer also to "unequal stretching of selvedges" and also to p. 80.

Although the selvedges may always be damaged in finishing by carelessness on the part of the workman, I cannot refrain from attending to the selvedge tearing or stretching caused by many kinds of drying machines.

With many old and some new drying machines the frame

tenter hooks lie decidedly higher than the turning point of the tenter chain itself. When the chain turns at the end of



the chain, the teeth spaces make a larger arc than the turning point of the chain. The difference sometimes amounts to $1\frac{1}{2}$ cm. By so much the selvages are compelled to stretch

between every two links of the chain. The result is sometimes a tearing of the selvedge or even of the edge, which with very different colours in warp and weft makes unremediable defects. In Fig. 46 we see the bent chain on the old system, where the points 1 and 2 are much further apart than any other pair, and therefore stretch the selvedge more, as the turning point *d* stands too low. If we consider Fig. 47 we see that there, although the chain is bent to the same extent, the teeth 1 and 2 are the same distance apart as the other pairs, and no tearing need be feared.

In the above-mentioned cases a defective selvedge may also be caused by carbonisation if it contains vegetable fibre and has not been properly neutralised.

Selvedges can also be called faulty with some show of reason if they ought to show the same colour throughout and do not do so. Such cases include the following, besides those above cited where single-coloured threads may be missing.

1. The production of yellow selvedges on indigo blue and other pieces with hot nitric acid, if this is not properly done.

2. Unequal reserving of the selvedges in such pieces in which it is to retain its original colour when the rest of the piece is dyed. These selvedges are wrapped in paper and then sewn up in a strong linen cloth. If this is carelessly done we get a speckled and uneven selvedge.

CHAPTER XII.

DEFECTS IN THE SHAPE OF HOLES AND NESTS.

THESE are manifold and are caused

1. By breaking of groups of warp threads on the loom.
2. By jerks and tears.
3. By careless handling in burling.
4. By mistakes in washing.
5. By mistakes in carbonisation.
6. By mistakes in milling.
7. By mistakes in raising.
8. By mistakes in shearing.
9. By mistakes in dyeing.

I. BREAKING OF GROUPS OF WARP THREADS ON THE LOOM.

This is but too common from many causes. For example, if a thread, a broken heald or any other object is laid in the warp, or an object falls near the harness. With metal healds, provided at the top with eyes, the falling of the healds into the warp can be prevented by passing a string or wire through the upper part of the healds as shown in Fig. 48. I introduced this practice in the winter of 1886-87, and in the following year it was patented by an Englishman.

If the shuttle sticks in the race, causing a trap, to the great dismay of the weaver, we get a particular sort of "holes" in the goods, recognisable at once by every expert. I use the inverted commas because they are not real holes but masses

of torn and reunited threads. They are usually threads which were over the shuttle when it got stuck in the upper leash. If the groups of broken threads are small the evil can be remedied to some extent by spreading the knots over as large a surface as possible. If the ends are broken off near the fabric, one is often obliged to pull out some of the weft picks. Sticking of the shuttle may happen from various causes, to wit:—

1. The shuttle box standing untrue to the shuttle race, whether at the bottom or on the reed side.

2. The presence of some resistance in the warp such as a mass of broken threads or a heald not fully lifted.

3. If there is too large a hole in the picker, whereby it does not pick the shuttle in a straight line.

4. If the pirn falls out of the shuttle.

5. If the picker spindle does not lie true to the shuttle race.

6. If in the act of throwing the shuttle is not far enough in the shuttle box.

7. When a shuttle is thrown from each side at once, and the two meet in the warp.

8. If the warp is not close on to the shuttle race.

9. If the reed is not properly fixed and vibrates as the shuttle passes through.

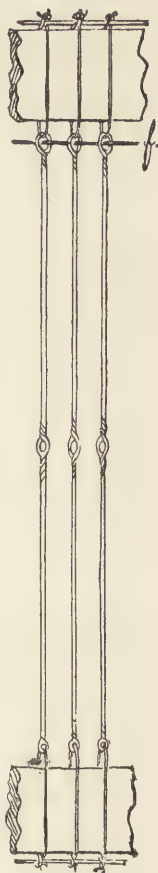


FIG. 48.

II. JERKS AND TEARS.

These are largely caused by improper management of the shuttle, especially if it is of iron, and particularly when the

breast beam is covered with iron. Evidently the goods may be torn by careless manipulation during any process whatever.

III. CARELESS BURLING.

Every master burler will often have scolded his workwomen for their favourite practice of tearing out burls, instead of carefully cutting them out. If the thread to be torn out is stronger than those which hold it, all are torn and a hole is produced proportionate in size to the number of threads torn. Even if the other threads do not break a defective place is formed by small bits of thread being torn out, or small broken pieces of stretched threads or defective weft are produced. Holes are also caused in burling by careless use of the shears, and careless bringing together of threads which ought to be separate. Finally, holes may result if nails are projecting in the floor, or get on to the pieces.

IV. HOLES FROM WASHING.

These are mainly caused

(a) By hard objects such as grains of sand in the washing liquid.

(b) If the rollers of the washing machines are broken or have projecting parts, or when hard objects such as glass, sharp stones, nails, bits of slag or the like have stuck in the rollers or draft board.

(c) If the upper roller is too heavy.

(d) If the under roller is not circular.

(e) If the goods get too heaped up in the trough, and do not turn round regularly.

(a) This fault may arise from bad fuller's earth, or from grains of sand coming with the water, or if the ceiling over the washing machine is plastered and bits of the plaster fall into the machine.

(b) With splintered rollers or rollers with projections care must be taken in adjusting them together. Many roller makers bore out projections and fill the holes with wood. This seems all right at first sight, but if the machine stands idle a few days the inserted wood dries quicker than the roller itself and gaps are formed between the inserted piece and the rest of the roller. If the machine in this condition is used for thin goods there is danger that these gaps may cut the fabric.

(c) If the upper roller is too heavy spots are easily formed, especially if a thick soap water is used in winter.

In many cases the pieces are washed singly. If the piece is put in the middle of the machine, the whole weight of the upper roller comes upon it and the roller tilts from side to side. Here, as a rule, the pressure is too severe and causes spots and also bad creases if the piece runs only for a short time in equal folds.

(d) If the lower roller is not true, cut-like marks are often made on thin goods, especially if the machine runs fast. The lower roller acts like a cam, lifting the upper roller at intervals and letting it fall with a jerk.

(e) If too much fabric is put into the wash trough at once, or the latter is not properly built, and especially when there is little washing liquid and the goods project above it and get tangled together, they remain standing and the rotation of the lower roller causes first rubbed places, and, if the rubbing lasts long, holes. Heaping of the goods also happens if there is too much liquid in the trough, whereby through want of room the goods may get wrapped on the lower roller. Here a taking-off roller, behind the machine, renders the best service.

V. HOLES FROM CARBONISATION.

If the goods lie long soured before going to the drying-room, or drops of water fall on them while soured, stains or even holes ensue. Refer to "stains from carbonisation".

VI. HOLES FROM MILLING.

Milling is the chief cause of holes, and they result

- (a) From hard bodies in the goods or washing liquid.
- (b) From wrong position or nature of the flanged and top rollers.
- (c) From wrong position or nature of the throat.
- (d) When the milling is too much in the width.
- (e) If the soap is poured on the dry goods when not fluid enough.
- (f) If the goods catch or tangle in entering the machine.
- (g) From projecting nails or screws.
- (h) With certain so-called one-sided goods.
- (i) In milling stocks if the goods do not move regularly.
- (a) If the pieces come much into contact with the floor.

If the wool is laid thereon to dry, as is a frequent practice, it may gather stones, bits of slag, etc. If these are not carefully removed, so that they get into the washing or milling machine, holes are unavoidable. See p. 100, *re* unsifted fuller's earth.

(b) If there is too little room between flanged and top rollers, the goods are easily cut in passing between them. The cuts come diagonally, but nearer to the direction of the warp than to that of the weft. The flanged roller must be as smooth as possible and not hollowed out in the middle, or else the goods easily catch between it and the throat.

The space between flanged and top roller must be at least 8 mm., and more, up to 15 mm. for heavy goods. It goes without saying that the top roller must have no sharp edges, as they may cut the cloth.

(c) The throat, which removes the goods from the rollers, is responsible for many holes. If it is too sharp and stands too far from the rollers holes are unavoidable. The distance from the rollers must not exceed 1 mm., and this is generally judged by putting a thick piece of paper between the two.

If the roller is hollowed out in the centre it must go to the lathe without delay.

(*d*) If the goods are too much milled in the length, the goods cannot get out of the machine and catch between flanged and top rollers or between throat and rollers, and easily get the dreaded cuts.

(*e*) With fine strong goods, on which insufficiently fluid soap is poured in the winter, thereby making the stuff sticky, the air bubbles formed in the sticky mass cannot get away quickly enough, especially if the machine is working fast, so that strong pressure causes spots.

(*f*) If the milling trough is badly constructed, so that the goods brim over, or if too large a batch is put into it, when several pieces are milled together, it often happens that the goods catch as they enter the machine. If the automatic back gear does not act at once, the goods stick fast, and are rubbed by the rotating tambour or roulette, causing rubbed places or holes.

(*g*) It is evident that if the goods catch on a projecting nail or screw a hole is very likely to be made. Hence the machine should be often inspected.

(*h*) With satins or similar fabrics, with a very close warp and rather little weft, or when the warp is of short material spots easily occur. When besides there are large extents of bare warp or weft combined with small ones, if, for example, the ground in a diagonal crosses with cloth or 3-leaved weave, and the warp is rather close, and the goods are to be rather forced in milling, holes often occur in the thin places.

(*i*) In hammer milling on the old system holes easily happen if the goods do not turn properly, so that they lie too nearly directly on the bottom of the trough.

VII. HOLES FROM RAISING.

Raising is easily overdone. It is much to be desired that every raising master should know something of weaving, so

that he could tell on inspection of the goods with what cards and with what force he ought to proceed, and, *vice versa*, it would be a good thing for the weaving master to have some acquaintance with finishing and raising in particular, so that the weave, warp, weft and yarn twist could be managed with reference to the subsequent operations. In this way the work of both would be facilitated. As it is, both are often puzzled to get the goods of the proper width and get the proper finish. The result is that the work is forced by one or both and holes frequently caused. Holes are often caused by cards projecting beyond the others.

VIII. HOLES FROM SHEARING.

These result mainly from the presence on the wrong side of the goods of thick knots or dirt or other foreign bodies, such as lumps of fibre.

All goods must be searched on both sides for knots, and the wrong side must be cleaned if necessary by a thorough brushing.

A knot on the wrong side is usually worse than one on the right side, as it presses the fibre towards the right side, and so offers a larger portion of the goods to the knife than if it had been on the right side, where it can often be cut off without much harm resulting.

Faults from the shearing machine also result if a cloth with rather a coarse-grained pattern, *e.g.*, strong granites, diagonals, or mats, is overstretched in the length on the machine, and shorn close. In this case the warp contracts and the weft stands out more than usual and bits of it get clipped off. If the piece is then raised somewhat on the wrong side, the remains of the threads are simply torn out, and the piece shows the appearances due to broken weft. An expert is not, however, deceived as to the cause, for he easily finds places where two or more breakages have not occurred.

These defective places are not exactly holes, but they are just as bad, for missing weft threads can be inserted. It is now, however, too late to do so, for we have to do with a finished or half-finished piece and an experienced eye would at once detect any such proceeding at this stage.

Holes the direct result of shearing are not uncommon and are due to all sorts of carelessness on the part of the workman.

IX. HOLES FROM DYEING.

Holes or tears caused by mechanical force are not the worst faults concerned with dyeing. They are the easiest to get over and are caused by careless handling and hanging and the like.

The pieces may also be made to hang in the dye vat by heaping up in consequence of bad construction of the vat. This easily happens with a single winch arrangement, and also with a too narrow vat with too steep sides.

CHAPTER XIII.

RUBBED PLACES.

OF these we distinguish two different kinds.

1. Those in which fibres which ought to be close in the fabric are loosened and to some extent pulled up by blows or rubbing, and cause the place to appear more raised than the rest of the surface.

2. Those in which the blows or rubbing acted so that the affected places look bare by fibres having been rubbed or knocked off.

Rubbed places may arise

1. In the loom.
2. In washing.
3. In milling.
4. In transport or handling.
5. In dyeing.
6. In pressing.
7. By freezing.

1. Many causes produce rubbing in the loom: (*a*) when the cords, *e.g.*, of the harness or parts of the machinery, rub the goods; (*b*) if the feeler of the cloth beam regulator for any reason catches. In badly constructed regulators it often catches in the toothed wheels outside the loom, and then rubs against the goods. Places rubbed in this way are easily recognised by their width and position; (*c*) if the temple is not set properly, so that its axle or other part of it rubs against the goods; (*d*) if the teeth of the temple reach in too

far and into the fabric itself and are somewhat bent, and when the little discs in which the teeth sit in some temples stick fast or turn with difficulty, so that the teeth checked in their travel scratch the fabric; (e) if as already remarked on p. 56 metal healds are used, and are not properly placed in the harness, so that they rub the warp; (f) when there is oil, dirt or size on the batten or breast beam, which has dried during a suspension of work, and which on re-starting rubs and scratches the goods.

Rubbed places caused by the loom are not always very injurious with certain goods, such as those that are to be raised, as the washing, milling and raising hide them more or less. With worsted to be finished smooth the case is worse.

2. In washing pieces we must be prepared for the occurrence, mentioned on p. 100, of sands or stones in the washing liquid or the fuller's earth. If, too, the goods stick fast in the wash from defective construction of the trough, or from overfilling of the machine, whereby the goods overflow while the rollers continue to revolve, rubbing easily occurs. Rubbing also occurs when, for example, pieces of different thickness or weight are washed together, and the lightest comes in the middle of the machine. This lightest piece then easily sticks fast and gets rubbed by the under roller.

Rubbing places occur also in the washing machine if the goods run for some time in equal folds, and these folds get fixed. If the corners of the folds rub against a hard body in the machine, whether at the entrance or the sides, the hairs first rub up, and if the rubbing is continued, become detached.

Thick heavy goods like eskimos and cheviots are, it is well known, very ready to fold in washing and so to get rubbed. Hence such goods should be well watched and not allowed to run along in equal folds, nor too dry.

3. Rubbing places from milling are often caused by the piece sticking, by over-beating, or by any special defect in

the machine, *e.g.*, if the throat or top roller is not properly placed, or if the goods catch between flanged roller and top roller whereby both rubbing and holes may be caused.

4. In the transport of goods in trucks or wheelbarrows they may come into contact with the wheels and be rubbed in all sorts of ways. They are the result of carelessness pure and simple.

5. Rubbing places also occur in dyeing, *e.g.*, when the sticks on which the goods are dipped are too sharp. Very bad stick marks are caused when pieces are being dyed in a thin walled pan, and the workman forces the goods against the side of the pan with the jigger, and leaves it there for a long time. At this place the goods get overheated and a "burnt place" is formed. Rubbed or beaten places also occur merely when the workman drives the goods too hard against the side with the jigger. The same thing happens if the goods stick together and the winch keeps on turning regularly.

A few years ago winches with copper arms were preferred, or winches entirely covered with brass, which are further covered with linen if there is any risk of rubbing. The dye vat is also divided by wooden frames into three, four, or more compartments, so that the pieces are kept separate, one in each compartment.

To prevent creases and inequalities in dyeing, Messrs. Bundgens built a full-width dyeing machine, shown in Fig. 49. It consists of a wooden vat, on which is a winch with rotatable arms. This changes in diameter according as the goods are running to left or right, so that they are kept automatically in the middle of it. A roller adjustable in a vertical direction and provided with scrapers is so arranged in the vat that it is immersed to a depth of about 10 cm. The goods coil round this roller and do not leave it until they have laid back a short distance in the bath. This prevents air from getting between the folds, so that the goods reach

the bottom of the vat without entanglement. Two oblique width-stretching bowls remove small irregularities. The machine works automatically full width without any assistance, and will dye three or four pieces or 100 to 120 metres sewn end to end. The machine is specially suitable for velvets, plushes, etc., and all goods having a tendency to crease or streak or to dye unlevel.

6. In hydraulic pressing, rubbed places may occur from sticking the press plates too hard between the folds or if the plates have too sharp edges, and also when the pieces do not lie properly one over another in the press, but overlap.

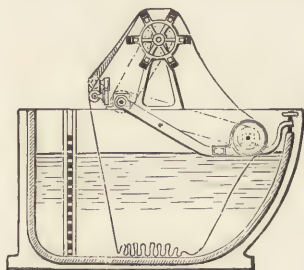


FIG. 49.

This last circumstance usually produces nasty creases even if it does not cause rubbing. In a cylinder press, rubbing places occur at the ends by entering the goods into the press carelessly. This is particularly the case in a link press, as the roller slides over the goods.

We have also the so-called "wedge places" when in a cylinder-press the goods are suddenly and forcibly pulled outwards at the selvages. This easily causes small folds, which are accentuated by the press. See also Chapter XIV. *re* press creases.

7. Rubbed places easily occur in goods frozen in the winter if they are carelessly lifted or carried. If frozen pieces are

hanging on a horse or wrapped on a roller they should not be moved till they are thawed. Hence pieces should not in winter be hung where they can get frozen. If they do so nevertheless, the horse or roller should be carried into a warm place with the goods on it and there thawed before the goods are taken off.

CHAPTER XIV.

CREASES.

THESE well-known faults arise

1. In washing.
2. In milling.
3. In raising.
4. In dyeing.
5. In pressing.
6. In decatizing.
7. In drying, sometimes.

1. Washing easily causes creases

(a) When the goods are only washed on the hank washing machine, and the cloth is rather heavy and hard and runs too long in equal folds, *i.e.*, without being turned over or without having the selvages sewn together. See p. 93 and No. 6 of this chapter.

(b) When a single piece is washed in the hank washing machine and allowed to run in the middle of the rollers. Here we often get crushing and creasing as the upper roller usually tips from side to side, and by so doing accentuates side creases. The pressure, too, is too heavy for a single piece and may cause spots as well as folds. Too heavy upper rollers often make very bad creases. The same thing happens when several pieces are washed together, of which one is much heavier and thicker than the others. The heavy piece has then to take pressure almost by itself, independently of the fact that then either it or the light pieces will not be properly wrung, and there is a risk that they will not come out properly cleaned.

(c) Creases are often caused when pieces are being washed which have been sewn together with too long stitches. Such creases, of course, occur only at the ends of the pieces.

(d) Other end creases result when, from motives of economy, yarn has been inserted there which mills differently from the piece. If the ends contract more or less than the piece creases are always caused, and the more so the wider the piece and the longer it is washed. Hence odd pirns should not be used in weaving the beginning or end of a piece. A few yards of yarn may be thereby saved at the risk of much damage to the goods.

(e) Washing creases are caused by the goods running too long dry, because the fibres are then less supple and creases are more permanent.

(f) Creases occur at the ends of a piece by running it side first, which almost always causes stretched corners and creases.

It would be a good plan to make hank washing machines with a contrivance for lifting the upper roller until the goods are thoroughly soaked.

(g) Creases also result from the use of a too thick washing liquid, as the stickiness of the same perpetuates any creases by making their sides adhere together.

As a precaution against creasing, the goods should often be taken from the machine and stretched on a bench, and, if necessary, a piece should be cut loose from the others and turned so as to run in the opposite direction. Others are not to work with too heavy upper rollers, and not to sew the selvages together with too small stitches, whereby the piece swells up in running and is always changing its position. Care should also be taken that there is not too much water in the machine, or the pieces do not sink deep enough, and easily get wrapped round the under roller if there is no drawing roller behind the pressing bowls.

Among the present-day hand washing machines full-width

machines are to be preferred, as less likely to cause creases. Although these are not without their faults, they have that advantage if carefully used and watched for the occurrence of creases. Unfortunately full-width machines wash slowly, and will not take very heavy goods at all, or they would be more in demand.

Creases are also caused if the goods run for a long time in small folds, *i.e.*, when the workman is careless and does not stretch them out.

For the removal of creases, see end of this chapter.

2. Milling creases are caused

(a) If the pieces run too long in equal folds, without being stretched out. The rule to stretch out often is especially important with heavy stiff goods like chevots. Such a piece should after a certain time be cut from the rest and run through backwards.

A French mechanician exhibited a milling machine at the Paris Exhibition which could be reversed. I saw the machine in action several times and considered it capable of improvement. But the man has the credit of having initiated a step in advance. Another machine maker proposes to avoid creases by sewing the selvages of the piece together, and putting a ball in the middle of the piece, under the entrance to the machine, to smooth out the piece before it goes in. I cannot see the necessity for a ball, for, as remarked on p. 112, the selvages are sewn together, so as to form a kind of pipe. This gets full of air, which has a great effect in preventing creases, as the goods are always inflated as they go in.

(b) If the goods are run dry too long.

(c) If the selvages are too tight and curled. See p. 80.

(d) If the goods catch here and there between beater and roller causing crease-like crushings.

(e) If the goods have been made too close or too wide, and must therefore be milled for too long, causing creasing by uneven felting.

(f) If the pressure of the rollers is too heavy.

(g) If the goods are only milled in the width causing creases by the piece always passing through in the same position. But if the goods are milled in the length, the beating acts favourably in so far as it beats out the creases. Besides sewing the piece in a pack, it may be allowed to run crossed over as a precaution against creases, but the former method is the better. In sewing weak goods into a pack, a break should be left every yard or two, so that the confined air can get out and not cause spots.

If the fuller has a piece on his machine and streaks appear during the milling he can prevent the fault by frequently removing and stretching the piece. It is also very advisable to take the piece from the unsuitable machine and finish it on another machine in which the piece is less stretched. Even if the piece does not get the full solidity required, this method is to be preferred, for in all cases we get a saleable piece which would not be the case if it had to be delivered with great streaks on it which can hardly be removed by any subsequent treatment, and in raising would be spoiled and cause great loss. Goods streaked after washing and milling are over should be raised with worn-out cards and then wrapped on rollers, and then stretched out full width on frames in the open air, so that the streaks cannot be seen. When dry, they are shorn, wrapped rather tight on a wooden roller covered with cloth, stretching them both in length and width. A piece of cover several metres long is then sewn on to the end of the piece, so that the end of the piece can also be wrapped on the roller, and the whole piece is protected from getting stained. The pieces are now put into a wooden or iron vat where several pieces can find room without touching the sides, and enough water is poured in to immerse the whole of the goods at least a few inches under the water. Steam is now blown in and the water heated to 50 to 60° C. according to the nature and colour of the goods.

This temperature is maintained steady for six to twelve hours. The vat is then allowed to cool thoroughly and the goods wound on the roller in as cold a state as possible, so that if they are not going to be raised at once they will not contract further creases, which it would be hard to get rid of. Streaky goods so treated can in most cases be raised on the large gig, and are then in many cases finished. If, however, streaks appear during the raising the piece is taken when about three-fourths raised from the large machine and stretched full width on lathes, so as to stretch the streaky places, and the raising finished on the small machine. In every case when the piece has to be dried, and especially before decatizing, care must be taken that it is stretched full width and dried when as flat as possible. In this manner it often happens that no trace of streaks can be seen in the finished piece.

3. Bad creases may be caused in raising by uneven raising when the goods are badly sewn together or when they are not properly stretched full width, whereby the cards bear unequally on the fabric, and also when the goods are too tightly stretched during raising. Streaks can also be caused in raising drapé goods and the like if they have been put in hot water before raising, either because they had milling blisters, and when it is desired to make them very soft. If these pieces are taken out for raising before getting properly cold, and piled up, so that they lie long in an imperfectly cooled state before being taken to the gig, it may happen, in spite of the stretching, that the creases produced by the folding preserve their positions exactly, and persist through all the various stages. If this is left unregarded while the goods are white we find the faults later in the finished goods, and consider it is impossible they can have arisen except by improper dyeing. In this matter the dyer is often made a scapegoat with great injustice. From what I have said the manufacturer can easily convince himself of the truth of this. I do not mean to say that creases can never

be the fault of the dyer. That they can will be shown in the next paragraph.

4. Creasing results in dyeing—

(a) At the ends of the pieces from sewing them together with too wide stitches.

(b) By improper use of the winch causing the goods to jam.

(c) By overfilling the dye bath, which is specially bad for cheviots.

(d) By insufficient cooling before lifting, whether they are wound upon the winch or piled on a barrow.

(e) If the pieces are dyed in too alkaline a bath, whereby they become hard and more liable to creases.

(f) If the pieces are sewn together with dry cord. When these cords get wet in dyeing they shrink and cause creases reaching a considerable distance into the fabric.

Creases from dyeing are usually called heat creases.

I have just spoken of creases from insufficient cooling. If the piece is wound hot on the winch and there allowed to drain and cool creases are produced by the pressure of the winch. If the pieces are piled on a table and do not cool fast enough special creases form lengthways in confused squares, known to every dyer, and called table folds.

It is best to cool in the following way: When the piece is to be lifted, place a movable wooden vat filled with cold water and with a cold water supply in front of the dye bath, and having cut off the piece, fasten a cord to the end of it whereby it can be drawn through the cold water in such a way that the piece goes first over a roller at the surface of the water, then over a longer one at the bottom, and then over a third as it leaves the cold water vat. The piece is then tabled cold. The sudden cooling prevents creasing, and the goods can thereafter be easily handled, being cool.

5. In hydraulic pressing creases may be caused by putting the goods badly into the press, and also by their shifting

over one another during the pressing. With the cylinder press creases may result from unequal running of the goods in the machine, at the sides from hasty stretching of the goods backwards and forwards, and by crumpling of the pieces. Under the last head I understand creases resulting from the pieces not running flat through the press in spite of all precautions. This may happen if the goods are rather thick and run with the smooth side uppermost and the roller is not coated with felt (see p. 61), or if the trough is bent in the middle or the roller is too smooth. The remedy here is of course to put the roller or trough right. Another cause is pressing very thin goods with strong selvages. No matter what the pressure, the selvages cannot be compressed enough to make the middle of the fabric to move at the same rate as they do, and hence oblique creases appear at the sides of the piece. Another important factor in this matter is that all pieces going to the cylinder press, whether the roller is or is not felt coated, are first thoroughly dried. It is thus easy to see that bagging can result chiefly from imperfect drying, and makes itself very evident as the goods issue from the press.

Although it is possible to do without felting the rollers, better results are always got when that is done. See p. 61.

6. Decatising creases may be caused in roller decatising, for example :—

(a) If the goods are put in the roller too loose, or loose in one place and tight in another. In the latter case we get a watered effect.

(b) A crease is easily made by the roller wrapping at one end of a fine piece, if the wrapping is too thick at the beginning. We use here, as is well known, a special wrapping, which is thicker at the end than at the beginning, or else a very long and thin wrapping to prevent this crease.

(c) Creases are formed if decatized wares are wound off directly after the admission of the steam and folded up

without getting properly cold, or are weighed with other pieces.

Too tight wrapping of the goods also produces the watered effect and also strained places.

Special precautions have to be taken against creasing in plate decatizing, as creases caused by it are much worse than those in roller decatizing. The back cloth laid under the piece, as well as that laid over it, must be absolutely creaseless, as every crease in them is impressed upon the piece. The press must also be so arranged that the pressure is uniform all over, or else creases or "clouds" are produced. Much care is required in piling the pieces for decatizing to make no wrong folds, and the piece must be laid out on each side 30 to 50 cm. wider than the pressure of the plates reaches. The parts which are thus not decatized are got as near as possible in the centre in the second passage.

The creases formed at the ends as the piece enters or leaves are repeatedly dabbed immediately after decatizing with a wet cloth rolled up like a thick pencil, so that the creases, being damp, are less evident. The same thing is done with deeper creases in roller decatizing. In this case, however, things may usually be put right by a treatment with hot water on the full-width washing machine or boiling machine.

With regard to decatizing full width or half width, the following rules must be observed. With large patterns, *e.g.*, checks, it is always preferable to decatise half width, as then the goods can be rolled up more uniformly than in decatizing full width. In the latter the checks easily get distorted, and the distortion is permanent. If checks are associated with a prominent pattern, such as ribs running lengthways, across, or diagonally, full-width decatizing must be resorted to, or else the cross weavings press across each other, giving a watered effect. If the wrong side of such goods is smooth, they can be rolled on without more ado, but if a marked pattern is on the wrong side a blanket with two smooth sides must be

interposed. The beginning as well as the end of the piece may be creased because thick goods, especially if the ends have been shorn smooth, may make impressions through variations in the position of the piece. It is therefore advisable, after the first and after the last position of the piece, to lay another blanket in the thickness of the cloth, and to make a fresh end by tearing the old one off evenly, whereby impressions may be avoided.

If the holes of the perforated rollers are not sufficiently covered by the blanket or the cloth itself, and the roller is not properly closed in the vat, dull places are readily caused (half-moons) at the selvages, where the steam escapes into the vat. These places are very difficult to get rid of. The removal of the lustre of the piece by boiling and subsequent pressing and decatising gets rid of the evil in many cases, but otherwise the lustre must be destroyed by a light milling. Improper position of the injector causes the water to be unequally heated, and it may too easily happen that the steam keeps back the water and penetrates the goods, allowing the water to come into contact with them cold instead of hot. If then we have ascertained by trial the right position of the injector it is advisable to keep to it to prevent faulty goods. If the air pump is worked too hard in sucking out the water from the goods, especially thin ones, they are drawn together and creases are made. Even if the air pump can be so worked in respect of removing the air before admitting steam, and of the penetration of the goods by the water, so that the goods can be taken from the vat as free from water as possible, it is, nevertheless, inadvisable to drive it too hard and it is better to leave a little water in the goods.

7. Creases resulting after drying are the least important, but I must, notwithstanding, call attention to them. They are caused by pieces coming from the hot drying frame or drying machine being piled, and weighted in some way or other.

CHAPTER XV.

STAINS.

THERE is hardly a manufacturer of piece-dyed goods who has not had to combat these evils, sometimes almost despairingly. In spite of the great care which everybody thinks he has exercised, stains will appear, and unfortunately their origin is never discovered.

I will here only collect some of the cases in which stains occur. They may result—

1. In the scouring of the wool.
2. In spinning.
3. In the loom.
4. In stocking the pieces.
5. In water.
6. In washing and milling.
7. In carbonisation.
8. In raising.
9. In drying.
10. In dyeing.
11. In decatizing.
12. In steaming.
13. In the sprinkling machine.
14. In pressing.
15. In the burling tincture.

I. STAINS FROM THE SCOURING OF THE WOOL.

The first essential for a fine piece of goods, especially if dyed, is a clean wool, as a raw material. Hence precautions

must be taken that the wool is thoroughly scoured. Every possible means is taken to get the wool free from grease and dirt. To do this we must not only use the proper alkalies but know the right manipulation of the proper temperatures to be employed, and the time necessary for the wool to stay in the lyes. I may here refer to the article on wool scouring on p. 85 of vol. i. of the *Handbuch der Weberei*. Many scourers are not careful enough about rinsing after scouring, especially about the temperature of the rinsing water. In summer, particularly in day working, the wool cannot be got so clean as in the winter, or as in night work. I have already remarked on p. 4 that for some years attempts have been made to avoid cold rinsing by increasing the number of warm rinses to as many as six or seven, with a gradually decreasing temperature down to lukewarm. This makes the wool distinctly softer. If the wool is not completely freed from dirt and grease the groundwork of a stained piece is already laid, and such wool must never be used for dyed goods without scouring it again.

I may here call attention to another method of scouring, executed after dyeing. If we have to do with a coloured raw material, whether pure wool or shoddy, or other refuse which has not been washed clean after dyeing, and comes into the warp or weft with other material, the finished goods often show stains, particularly if too strong a washing lye is used. The residual dye then dissolves uniformly and stains are caused.

II. SPINNING STAINS.

Here we have two sorts, the chief being those caused by greasing the wool with unsaponifiable oils. All sorts of cheap stuff are now used for this purpose, decoctions of Iceland moss, cocoanut oil, the carbonates of soda and potash, oleine, petroleum, sal ammoniac, waterglass and glycerine, etc., or combinations of these. That these mixtures often

contain petroleum is easily proved by analysis. From an action in the law courts it appears that oleine containing 70 to 80 per cent. of petroleum has been sold for greasing wool. See p. 361, vol. i., of the *Handbuch der Weberei*.

A manufacturer of my acquaintance was troubled for years with stains, and as he was also a maker of stocking goods had to deal with evil-smelling yarn. He lost his yarn custom entirely, and his goods were in disfavour on account of the stains. The blame was always laid on the scourer, but I insisted on an examination of the oil, and it turned out to be oleine containing 10 per cent. of petroleum. When he used pure oleine both stains and smell disappeared.

To see whether petroleum is present in the oil, refer to p. 361 of vol. i. of the *Handbuch der Weberei*. See also the recipe for a cheap wool oil on p. 361.

In adding water take rain water if possible, but never condenser water, which usually contains petroleum from the lubricating oil of the steam engine. Many think that too much water injures the wool grease. On p. 820 of the oft-quoted *Handbuch* it is shown that a thread soaked with water is more extensible than one soaked with oleine, and still more than one soaked with oil. A thread of 18,000 metres gave the following average extensibilities:—

	Per Cent.
Dry	13·15
Wetted with water	42·8
„ „ petroleum	14·95
„ „ rape oil	16·95
„ „ olive „	16·25
„ „ oleine	15·35
„ „ wool grease	44·25
„ „ soap water	44·10

It is obvious that neither water nor soap and water can be used alone, for fear of rusting the cards. With imperfectly scoured wool it is advisable to grease with more oil, thereby

ensuring better penetration of the suint remaining in the wool, and facilitating the subsequent saponification.

A second kind of special spinning stains, which only appear with delicate and white colours, arises from card teeth falling out. These get spun into the thread and cause tiny rust specks which can be seen in almost any colour except black. After dyeing we often find the piece of iron still in the cloth.

III. LOOM STAINS.

We have here stains from rust, mildew, petroleum, fruit, tobacco and dirt.

Rust stains appear: (*a*) when yarn is woven from imperfectly tinned reels and has stood a long time damp on them; (*b*) if the yarn has been wetted in an imperfectly tinned pail, in which the water has stood too long: the rusty water soaks into the yarn; (*c*) if the breast beam has iron in it, and the iron remains long in contact with wet-weaved goods; (*d*) if iron or steel shuttles are used, and are left lying a long time on the goods, say over Sunday; (*e*) if an iron width stretcher is used with wet goods; (*f*) if the cloth beam is covered with iron eaten into holes and the goods are wound on it wet; (*g*) if a rusty reed is used: hereby much damage is done to goods to be afterwards dyed light shades; (*h*) when badly tinned iron harness is used, and it gets wet, whether from the weaving shed being damp, or from wet warp, or because it stood in a damp place before being put into the loom: the harness being rusty makes rust marks on the warp; (*i*) when the loom is under iron rafters from which rusty condenser water may drip; (*j*) when the feeler of the cloth beam regulator is not covered, and comes into direct contact with the goods. See also p. 106.

Mildew stains result from the growth of fungus when the goods stand wet for a long time. At first the fungi are only on the outer threads and do not do much harm, but when

they have penetrated the interior of the fabric they destroy the wool, and the stains they cause are then irremediable. Mildew stains are caused in weaving: (a) if the warp is beamed too wet, and stays too long on the yarn beam; (b) if the weaving is done very wet, and the cloth has to stay a long time on the cloth beam, especially if the temperature is rather warm, or the cloth is folded up in an insufficiently ventilated box under the loom.

The best way of preventing mildew staining on the yarn beam is to beam the warp in a properly dry state. If there is risk of mildew in wet weaving about 3 per cent. of boric acid should be added to the water used. After dyeing, mildewed spots generally appear lighter than the rest. See also p. 44.

Care is also required against mildew stains in finishing, especially with indigo-blue goods. If such mildewed pieces occur, the first thing is to dry them, for the grease together with the water present causes mildew during long lying under pressure. And in every other process, particularly in raising before decatizing, unnecessary lying in a wet state, especially in hot and thundery weather, should be avoided, or at least the goods should be frequently turned over.

OTHER STAINS.

Petroleum stains are mostly the result of over-lubrication of the machinery. When the weaver oils the shuttles he often puts enough oil to drown them, and then lays them on the breast beam or on the cloth. Besides, he smears the warp with petroleum when it does not travel as he wants; moreover, lubricating oil may drop on to the goods from bearings above the loom. Stains of fruit or tobacco often do damage, especially to white goods to be afterwards dyed.

Here I may include stains resulting, for example, when blue or other coloured warps have been woven, and have left behind hairs, dye and dirt on the harness, comber board

or breast beam to dirty a white warp coming next, and to make on it lengthways streaks which usually can never be entirely removed.

IV. STAINS FROM STOCKING.

As already said on p. 123, mildew stains easily occur on the loom. They occur quite as easily when wet cloth from the loom is not dried, in case it does not go at once to the wash. The same is true of pieces which lie too long heaped up during washing or finishing, or are hung over a horse. If goods are to remain on a table, barrow, or horse, care must be taken that the wood is properly scoured or else it may cause rosin, mildew, or, in the case of oak, tan-marks. If the goods are already spotted with mildew, care should be taken not to put them with undamaged pieces or they will inoculate them with fungus spores. Pieces should never, if it can be avoided, be hung on horses when wet or soured, mordanted or dyed, and if it must be done they should not stay there longer than is absolutely necessary.

V. STAINS FROM WATER.

For the examination of water refer to the *Handbuch der Weberei*, vol. i., pp. 233 *seq.* Here I will only say that very hard water is bad for washer, miller and dyer. It is bad for the first two because it wastes soap, and for the last because he often gets pieces which have not been freed from the lime soaps formed in washing with hard water, and consequently gets unlevel dyeing.

Ferruginous water is particularly bad in dyeing, especially for light shades, which are sometimes impossible with a water containing much iron. Water is not only naturally often impure, but is often artificially made impure in all sorts of ways—for example, by drainage from factories and canals. It happens very often that a washer has to depend

for his water supply on contaminated streams, and yet he is expected to deliver perfectly clean goods, and the dyer to get good colours conformable to pattern. See also decatizing and steaming.

VI. WASHING AND MILLING STAINS.

Here stains result—

(a) If strong washing liquids are used on loose dyes.
 (b) If over-strong lyes are poured straight on to the goods and not into the bath itself. This is very important with delicate colours.

(c) If bearings over the washing or milling machine drip petroleum on to the goods, so that an unsaponifiable oil gets into them. Lubrication of the milling and washing machines should be done with rape oil only, to avoid stains as far as possible. Many manufacturers direct their men to use only rape oil for bearings above the machines, but here there is a danger that if the man is allowed to use petroleum for the lower bearings he will do the same for the upper bearings.

(d) If the washing is done too fast. If the dirt is loosened on the surface and too much water is used at once only the surface dirt is removed, for the goods will very often stain and cloud in the dyeing. The grey appearance of many ready shorn carded wool goods is usually due to bad washing, and the fabric, even if of good quality, becomes unattractive in appearance and of small value. This must be avoided by thorough washing. If the goods are rinsed lime soaps are formed in the fabric which even repeated further washing will remove but imperfectly, or not at all. If such a badly washed piece gets into the milling trough it will not felt properly, because the lime soap holds the fibres and prevents them from felting, or only lets them felt imperfectly. No care on the part of the miller will enable him to turn out a faultless article under these circumstances. It will be found that the

milled cloth has not the proper handle and always feels too hard. If the goods are crumpled they long retain the creases, while in a good piece they disappear when the crumpling ceases. Besides, the piece will not raise properly. The most energetic raising will not penetrate to the ground and produce a fine soft fabric, and the piece retains its harsh feel. If such a piece is over-raised the hairs get torn off. Great care also is required in shearing such a piece, as it can very easily be shorn too close, as the hairs stick up too much and the goods readily assume a streaky or grey appearance. Such a piece should only be pointed round, *i.e.*, fine, and none of the nap proper should be cut off. If black carded wool has a lustre after finishing, it is a sign that it has been over-raised after dyeing, or cut too close. Hence it is better to raise and shear before dyeing. I might here mention a case in which some pieces were sent to me for examination, which had been dyed with diamines, and which showed dark cross streaks. After a lot of trouble it was discovered that when the undyed goods were washed with soda the workmen, in a hurry to get home, had run off the washing liquid too soon. It still contained too much soda, which accumulated in the lower folds of the cloth as it lay in the machine.

(e) If residues of soap remain in the goods, especially if the water is hard. These residues often cause spots and clouds. These stains are sometimes sharply bordered and sometimes not. The latter usually result from soap left after imperfect rinsing, the former usually from chance spurts of soapy water falling on the goods. Splashes of neutral soap give the well-known light silver stains, while splashes of very alkaline soap make dark stains, which are very conspicuous on light mode shades.

(f) If goods dyed with loose colours have to be milled care must be taken to use cold water and not to warm the machine too much or the colours will bleed, usually doing so irregularly and hence causing stains. If it is

indispensable to mill such goods, the doors of the machine should be left open and the cover lifted often to keep the goods cool.

(g) Dirt in the milling machine often causes stains. If half-milled goods stay over-night in the machine, or new cylinders are in use which have not been properly cleaned, stains often occur. If lumps of dirt from the machine get on to the wet goods they are absorbed, and usually spread over a large surface. Hence the machine must be kept clean. Every piece should be treated with fuller's earth after washing to remove all soap and dirt residues, and the earth should be used freely and not in homeopathic doses. The lye of the earth should not be made too thin or it will be practically wasted. In many cases, to save time and money, goods of different colours are washed together in the skein washing machine. This is a gross error, and often causes stains. Washing stains run mostly lengthways and dyeing stains in all directions. I refer here to "removal of soap residues".

VII. CARBONISATION STAINS.

If the acid bath is not properly stirred, or if the goods are piled up too long before centrifuging, or are insufficiently centrifuged and then hung up so that the acid collects in the lower parts, well-marked stains appear later. Carbonisation stains also result on goods which are not free from oil or soap. Hence the carbonisation in the raw state practised in many factories is worthless. It is done to save a little time and soda, and then people cannot understand why they get all sorts of clouds in the cloth.

Carbonisation stains and even little round holes happen if drops of water fall on the goods before or during drying. The ceilings of the carbonising chambers must always be kept clean, for the condensation of vapours from the goods forms a thick liquid on the ceilings which falls on the goods, and,

containing an excess of acid, causes very bad stains or even holes, especially if the roof contains bare iron girders. The more rusty they are the worse the stains. The pieces must not be taken out of the chamber till quite dry, but must not be long left there piled up, for they evolve acid fumes which cause much damage. Soured goods must be protected from light and sun, which cause pale stains in which the fabric is tendered, whether they are piled or not. The streaks thus caused remain visible after dyeing, and may be known by their distance apart and by running never exactly along the threads, but to a point towards the edge of the cloth. Stains also ensue if dirty sour liquid centrifuged out of the goods is used over again. Such stains look very bad in the unfinished goods and ruin the dyeing. Hence, especially if light shades are to be dyed, a fresh acid bath must be used, although for dark shades the acid liquor may be used again. Again, stains are caused if the goods are exposed to great heat in too damp a state, for the acid vapours then condense in the edges and cause brown streaks, which sometimes corrode the fabric into holes. In closing this head I may give a few hints on carbonisation. The strength of acid used is from $3\frac{1}{2}$ to 5° B., but many manufacturers go up to 7° B. The goods to be carbonised must be absolutely free from soap, and the acid bath must not be too old and dirty, and its strength must be tested after every few pieces. In souring the goods they must be completely immersed and must be wound round at least four times to soak them thoroughly. Of late a sort of light skein washing machine has been introduced for souring, in which the goods are well kneaded during the process. This is an advantage, especially with heavy goods. The piece is then piled on a board or barrow in such a way that it can drain into the bath, or, if possible, it is wound on a winch, left to drain for ten to twenty minutes and then centrifuged. It must not be long left wet with acid, as the acid accumulates in the folds, and is apt to cause rotten places there.

The best centrifugals consist of a wooden or cane basket work. The centrifuging had better be over than underdone. Very heavy goods, such as eskimos, which have to be dyed light shades, should be centrifuged twice, first with one end below and then with the other. In this way all excess of acid is eliminated, and hence any gravitation of acid into the lower parts of the fabric during drying is avoided, and so there is no danger of unlevel dyeing of the edges. This unlevelness usually occurs on only one side of the piece, that which lay uppermost in the hydro-extractor. Hence if the piece is reversed and centrifuged a second time the evil is avoided.

The goods must be shielded from light, especially the direct rays of the sun, so that they must be covered up till they get into the drying-room, and that room should be darkened with ground glass windows. The reason is that the light decomposes the acid water, causing, it is supposed, the formation of peroxide of hydrogen, a bleaching agent, which alters the fabric at the light-affected places so that they dye differently from the rest—darker than the rest with some dyes, and lighter with others. If, too, the goods are left piled in acid state before drying they must be kept cool, but they should be dried as soon as possible after centrifuging.

In hanging up the pieces take care that they get no tapering folds. To ensure this do not bend the piece sharply at the sides of the drying-room, but in two right angles, as shown in Fig. 50. *a* and *b* are the walls of the room, and *t* the upper edges of the piece, about 6 cm. apart. This prevents unequal drying and hence many streaks or stains, as the rising vapours cannot settle in close folds.

If there are two parallel frames near each other in the room, see that they are far enough apart to prevent any contact of the folds. If wet parts of one piece touch a cloth put earlier into the room and which is dry, mischief is caused. The drying temperature should be at first 40 to

50° C., and the room must be thoroughly ventilated to get rid of the vapours. Later the temperature is raised to 60 to 75° if sulphuric acid is used. If, however, aluminium chloride is the carbonising agent, we begin with 40 to 45° and finish with 100 to 105°. This final temperature requires the use of high-pressure steam.

The time required for carbonising depends on the weight of the goods and their state of cleanliness, and varies from three to six hours. Not only must the goods be protected from water after the drying, but they must not be left in a damp room while still containing acid, because they will then absorb moisture, and become stained. If they cannot be neutralised at once, they are placed in a cold dry room, and carefully covered up.

Before neutralising the piece wash it in water for about half an hour before adding the carbonate of soda, which is added in the form of a 3 to 4 per cent. solution. Care must be taken that the solution is not poured straight on to the goods, or soda stains will arise. It is a good plan to lift the goods while the soda is being added, and not to put them back till the bath has been well stirred.

Of late a sort of full-width washing machine with two pipes

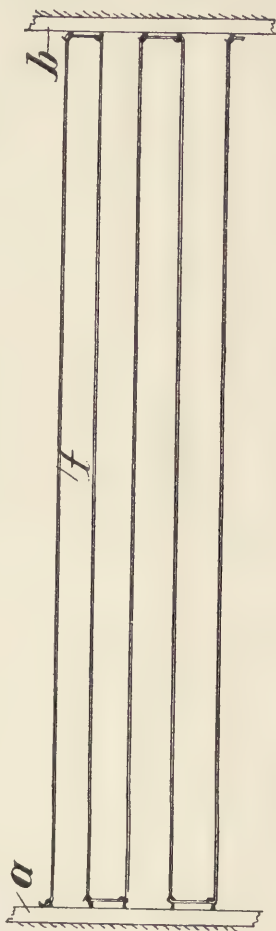


FIG. 50.

has been advantageously used for neutralising. The lower pipe admits water, the other the soda solution. The two liquids are run into the bath slowly and together. The soda is poured into the upper pipe by a funnel, after the water has been started. With this arrangement there need be no fear of the soda falling direct on the goods, and lifting is unnecessary.

Soda stains look as if the goods had been trailed through dirt, and after dyeing are darker than the rest of the piece. It is very advantageous to stretch the piece full width before neutralising, to prevent folds and ensure good penetration of the liquids. After it has run at full width for about a quarter of an hour only, creases need no longer be feared. Care must, however, be taken, unless the upper roller is very light, that it is put out of gear.

The neutralising takes usually one and a half to two hours, and its progress should be tested with blue litmus and continued till the paper is not reddened. The sun must never shine into the place where the goods are soured, wrung or neutralised. This is prevented by suitably arranging the windows or making them of ground glass. If this precaution were universally observed we should avoid the greater number of carbonising stains and the dyeing stains therefrom resulting.

The question as to when the carbonisation should be done is of importance. It may be done—

1. With raw wool.
2. With the unmilled piece.
3. With the milled piece.
4. After dyeing.

If the raw wool is to be carbonised it should be done only in the grease whenever possible, at least if good wool is under treatment, as the hair is then better protected. If the goods are carbonised in the unmilled piece the felting power of the wool is impaired, but the process requires less heat and acid

at this stage, for the burs are not so firmly fixed and the subsequent milling guarantees full neutralisation. In carbonising after milling we have only the advantage that the goods mill more easily and give less waste, partly because the milling is sooner over and partly because the goods come softer to the milling. Carbonisation is best done after dyeing when the dyeing has been in an acid bath, for the uncarbonised stuff dyes much more level and with less risk of spots or clouds.

STAINS FROM CENTRIFUGING.

If pieces of different colour are centrifuged together or wrung on a width wringer, and the liquid from the dark pieces passes through the lighter ones, the latter are stained. If this is done with the full-width wringer the lighter pieces must always be put between them and the darker pieces. Then the dark liquid does not touch the light-coloured pieces.

VIII. STAINS FROM RAISING.

Here we have iron, mildew and oil stains. Iron spots may be of various origin. If the gig has rusted while idle and is not cleaned before being used again it makes rust marks on the cloth. The machine may be rusted also by wet goods during the raising if it lasts a long time. Rust marks are also caused by sprinkling with rusty water from a rusty pail, and also if rusty water drips on the cards from iron girders.

Mildew stains can be caused by card teeth being broken off and getting fast in the goods. Fungi are then apt to grow where the tooth is embedded. These stains are also caused by the goods lying too long piled up, especially if they come into contact with wood. Here I may mention a case in my own experience. A particular factory got, for a long time after dyeing with light shades, round stains, which were always put to the disadvantage of the dyer. The stains were often half a metre apart. After a long time the raiser con-

fessed that he had noticed that when white pieces had been piled up only for a day round patches appeared in the middle, and that he thought that they came from the width stretcher of the double-raising machine, as he had often seen, when the machine was running empty, something fall from the middle of the width stretcher, and so thought that the stains were caused by rust. In investigating the matter in the factory I examined the width stretcher, and found to my astonishment twenty or thirty small corroded card teeth, which had fallen into it. The wooden parts of the width stretcher were very worn, and an opening had formed through which the card teeth had fallen on to the goods. These teeth showed, under the microscope, numberless fungi and several lumps of rust. It is, therefore, no wonder that the effect ensued so quickly after the raising, as the mildew was already present. The rust, too, explains the rust stains.

We may distinguish various sorts of dirt stains, *e.g.*, drippings from bearings lubricated with petroleum, mixed too with bits of brass or the like.

I must also here mention some special stains of rare occurrence. In examining a piece of white worsted fabric hundreds of stains of all sizes were seen, some round, some oval, some vermiform—in short, of all shapes. It was also found that almost all parts of the piece where the stains were showed a sort of central grouping of the largest stains. This led to the right conclusion, *viz.*, that the fault was probably in the raising when the goods were often sprinkled. The workman concerned disavowed all knowledge of the affair at first, but when assured he should not be fined he admitted that he had got a new driving belt which was too stiff, and that to soften it he had left it in a pail of water over-night. When he took it out next day he forgot to throw away the water, and used it to sprinkle the piece.

After this, I should like to offer all manufacturers the well-meant advice, that if the cause of a fault is not discovered

they should, rather than threaten punishment, offer a reward to any one who can throw light on the matter. Then the question will often be explained astonishingly soon, and the person at fault will have every inducement to be more careful in future. It will also be made clear whether the fault was the result of carelessness or could be any ground of complaint.

IX. STAINS FROM DRYING.

First among these I may place those caused by drying white goods on iron frames not properly painted. These occur principally on the lower selvedge. I have seen stains caused by drying ordinary pieces on such hand frames used before for soured goods. I also remember a case of the drier being careless enough to hang an unsoured over a soured piece, although this may be thought scarcely possible. Here, of course, the overlooker is more to blame than the workman, as he ought to have warned the man who was not skilled at carbonising.

Stains are easily caused by drying in the sun, whether the goods have been dyed before or after weaving. In the former case, if the goods are hung with the right side in the sun the colours usually suffer, especially if the cloth hangs in folds, for then the action of the light is unequal. This happens even with white goods unequally illuminated, as the places getting most light are more bleached, and made more sensitive to dyes. In drying under cover stains may be caused if the steam pipes leak. The escape of steam causes a kind of decatising where it strikes the cloth. These places never get properly dry, too, and if shorn in that state shear unevenly.

X. STAINS FROM DYEING.

The two chief scapegoats of the wool trade are the carboniser and the dyer. Although, no doubt, both have much on their consciences, they are often blamed without cause. I

will presently discuss some ways in which dyeing stains may occur, but will first enumerate the chief conditions of success in dyeing, as follows:—

- (a) The wool must be free from grease and dirt.
- (b) It must be greased for spinning with saponifiable oil.
- (c) It must be suited to the dye.
- (d) It must come free from grease, soap and stains from washing and milling.
- (e) It must come without fault from the carbonisation.
- (f) It must come without fault from all finishing processes.

It is necessary that the wool should come from the wash free not only from oil and dirt but from excess of soap or alkali. It must therefore have been properly rinsed, and should be finally rinsed with fuller's earth.

If it is certain that the above six conditions have been fulfilled, any fault can be laid at the door of the dyer.

In piece dyeing stains result from dirty vats or from vats made of resinous wood from which the resin has not been scoured out. Square dye vats are now almost invariably used, and most of them are made of pitch-pine, and when new have to be boiled for four or five days with washing-soda before they can be used. The same is true of all wood used in dyeing barrows, benches, etc. Some people sprinkle rosin on slack driving belts, which may then cause rosin stains.

Stains may be caused by imperfect solution of the dyes, and the vat should also not be boiled while pieces are being sewn together by the ends or selvages, and also by not keeping the dye bath clear after adding mordants or dyes, especially alum or tartar, as well as by careless handling of acid or dye, *e.g.*, in grinding alum or dyewood extracts. If leaky vessels full of dye or mordant are carried through a dyeing or finishing shop the liquid which escapes often gets on goods and produces small stains. If certain mordanted goods are hung a long time to drain, and the mordants were not first properly diluted with water, they accumulate in the edges and cause

stains by making that part of the piece more receptive of dye. If the goods are unequally soaked in the dye bath stains ensue, so that the practice of many dyers to soak the goods under pressure in a skein washing machine is praiseworthy, and much to be preferred to mere winding on the winch. If the goods are entered too hot and the dye goes on quickly the last part of the piece will always be lighter than the rest, and the dyeing will be unlevel, especially with anthracene colours, and stains must ensue. If the goods are winched too fast, the bath cools rapidly, or there is a waste of fuel or steam in keeping it hot. Hence many workmen turn the winch very slowly, and streaks from want of uniformity may thus be caused. If too much cloth is put into the bath the liquid does not envelop it sufficiently and cloudiness is the result, as the fabric cannot be turned over properly (see p. 108). If the dye liquid cannot get at the outside of the goods bubbles of air form, and at those places the outside gets cold and will not take the dye, so that the outer part of the inflated portion is paler than the rest. Imperfect immersion when there is too much cloth in the vat also causes stains. If the pieces are hung on horses which are wetted with soda before entry into the vat, streaks are made by the soda gravitating into the edges. The pieces must be laid on a table or barrow. If pieces dyed in the indigo vat are not at once washed, they become not only clouded but rotten. Great care must be taken with pieces which have had a preliminary blue dyeing to cool them thoroughly, and to turn them over often when piled up, as they will otherwise heat spontaneously in twenty-four hours. If the goods are not boiled long or thoroughly enough, good penetration cannot be expected, and part of the dye will be washed away in rinsing, and the parts exposed to wear in the finished garments will lose dye by rubbing. If the goods are pressed down in the dye bath with sharp sticks, or if they are kept in contact with the hot sides of the dye bath, streaks will result. Dark stains result when

mordanted pieces are not protected from both sun and air. Stains are also caused by dyeing a piece containing previously dyed yarn, especially if the yarn was dyed with loose dyes, as is often the case with under wefts. If these dyes come off in milling or washing they often bleed on to the white parts of the cloth and make streaks. When the whole piece is dyed, these parts will come out darker. They are easily recognised by not following the threads exactly, and by often coming to a point and suddenly disappearing.

The chief enemy of the dyer is dirty cloth containing unsaponifiable oils, lime soaps or ready-formed stains. If, for example, a piece containing soap residues is dyed in the indigo vat, white specks result in the goods.

Many manufacturers err by dyeing mode shades on doubtful pieces, or pieces made of all sorts of mixed wools. For these mode colours we should use only the purest and whitest pieces, and not the first which come to hand.

Most of the stains caused by soap residues cannot be removed by ordinary washing. I should wish to advise every dyer to subject all pieces of the cleanliness of which he has doubts to the following treatment. Work the piece cold for about half an hour in dilute hydrochloric acid of about 3° B. by hand or in a light skein washing machine, and then rinse with clean water and finally with washing soda. The object of this is to decompose any lime soaps present. The calcium chloride formed is removed by the water and the fatty acid set free by the soda. Others recommend washing the piece in a 1 per cent. solution of acetic acid before dyeing. Lime soaps may also be got rid of by a thorough preliminary treatment with fuller's earth, then with soda, and then with fuller's earth again, finally rinsing in clean water. All pieces to be dyed light shades should be treated with fuller's earth after the above treatment with acid and soda.

Let then the dyer see to it that all his apparatus and

utensils are kept scrupulously clean. I cannot avoid here relating the case of some remarkable stains.

Round stains showed themselves on a dyed piece, causing it to look as if some one had walked about on it in boots liberally provided with nails, but none of the men concerned wore such footgear. Careful inquiry revealed that these stains corresponded to the perforations in a false bottom in the vat. The piece had lain repeatedly for some time on this, and the hydrostatic pressure had pressed it into the holes. The false bottom had not been cleaned for some time and had caused the formation of the peculiar stains. I know another case in which a dyer was always getting dark ends to his pieces. Investigation showed that the man who sewed the pieces together let the end of the piece hang in the dye liquor during the sewing. Dark stains on the end of a piece also result if the rollers on which the piece is rolled after decatizing and where it stays for some time are not quite clean, or have not been properly scoured before being put into the machine, as they are best made of pitch-pine, which is very resinous. Uneven shorn goods, too, look unlevel after dyeing.

It should here be remarked that sharp decatizing causes the dyeing to come out lighter than would otherwise be the case.

Dye stains rarely or never penetrate quite through, while stains caused in the finishing usually appear on both sides of the piece.

Refer to Chapters XIII. and XIV.

XI. STAINS FROM DECATISING.

Decatizing stains mostly result from water, so that they are often called water stains. Water often reaches the goods with the steam which has been formed by condensation in the pipes or other parts of the apparatus and has not been drained off. This is very apt to occur in winter. As soon as

the weather begins to get cool in autumn the steam valve should be opened longer before the decatizing is started. The steam passing through the apparatus should not be allowed to escape into the workroom, to prevent the falling of condensed water from the ceiling. Water stains may also be caused by priming when the steam carries liquid water from the boiler on to the goods. Decatizing stains also happen if the roller is not properly covered, whereby the steam strikes too violently upon the goods, and also if the covering is too thick, as the end of it then leaves its imprint on the goods. Only thin stuff should be used to cover the goods on the roller, but enough to prevent them from cooling too fast. See pp. 117 and 118.

Stains may also be caused by impure feed water, by matter from the inside of the boiler plates or by petroleum or chemicals put into the boiler to prevent furring. If the steam primes these things are carried over in contact with the goods.

Moiré stains often result from decatizing. Such goods as are liable to them should be pressed very slightly, or not at all, if possible, before decatizing, and should not stay too long on the rollers after steaming.

Certain decatizing stains are called clouds. These must be watched for with conspicuous patterns on either or both sides of the piece. If a projecting pattern is pressed on to a smooth cloth it indents it more or less and produces a moiré effect. This often happens with eskimos, where the wrong side is usually twilled and the right side smooth. There are three ways of remedying this matter. One is to decatise the piece folded so that right side is against right side; another is to insert a blanket; and the third is to decatise two pieces together with their right sides in contact.

Too tight or too loose wrapping of the goods on the roller also causes cloudiness, as does the careless practice of putting rollers full of still hot goods so that the cloth on one touches

that on another. The parts of the fabric in contact cool more slowly than the rest, and "half-moons" are produced at those places, which if the piece is at once dyed become visible, and remain so.

Decatising stains also are caused by the condensation of steam in the workshop, and the dripping of the condenser

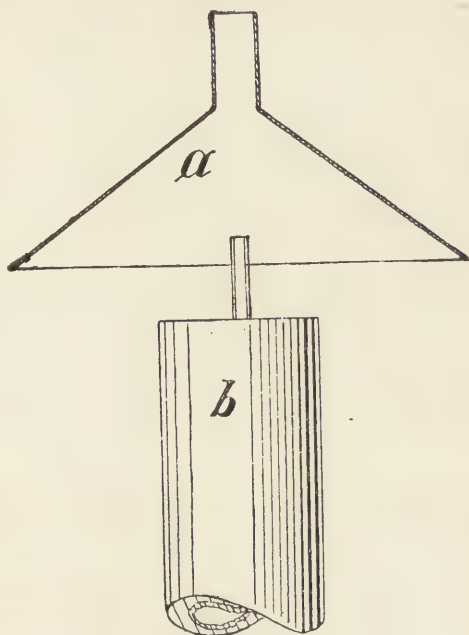


FIG. 51.

water on the cloth. To prevent this, a special shield shown in Fig. 51 should be used.

a is the shield and b the roller. If steam condenses on the shield it runs down the slanting sides and falls near the roller. As a further precaution, a gutter may be put under a to catch the water and carry it away. The drops of water

can also be made harmless by putting a thick cloth above the roller if it is one with a vertical axis.

What has been said about roller decatizing applies equally in many cases to plate and closed decatizing. Care must always be taken to have the steam as dry as possible, and the goods rolled up smoothly or very accurately folded.

In plate decatizing care must be taken that the steam chest is well closed above with a packing of hemp and red lead. The red lead must be mixed rather stiff or the steam will break it up. If the chest leaks, water stains often result at the sides where the steam strikes the goods. Before admitting steam to the chest take care as in roller decatizing to drain all condenser water out of it and from the pipes.

Decatizing stains are usually sharply outlined, and they dye darker than the rest of the piece. Even on black they look darker than the rest. Be careful always not to use pieces with decatizing stains for dyeing light shades. Refer to "removal of decatizing stains".

XII. EVAPORATING STAINS.

If the evaporating apparatus is so constructed that water is thrown on the goods, or if all condenser water has not been drained off at the beginning of the process, water stains easily occur.

XIII. SPRINKLING STAINS.

These often occur if the sprinkling machine gives out too much finely divided water, if the goods do not travel uniformly, or if the water is not sprinkled uniformly. If the goods are too dry for pressing it is better to heap them up loosely in a damp room, turning them over several times, or to hang them in folds on a frame so that they may absorb water.

XIV. PRESS STAINS.

Besides oil stains from oil which may fall on the press or the goods, these stains are almost solely water stains, resulting, for example, from the cylinder press not being sufficiently heated at the beginning of the pressing. It then sweats, and drops of water fall from it on to the goods. If, too, the pipes of a roller press or a heated hydraulic press leak, water or wet steam reaches the goods. I may here mention various cases in which the goods will not go through the roller press, *viz.*: (a) if the upper roller is too smooth. This over-smoothness may be removed by the application of dilute sulphuric acid and then letting the roller dry, first cleaning any rust off it. Others rub the cylinder with worn-out emery paper; (b) if the roller is rather thick. In this case it closes more above than below; (c) if the roller is too thin. Then it only closes below in the middle; (d) if the trough is too rough the goods stick fast in it; (e) if the goods are not clean.

The following interesting case happened a few years ago after the erection of a new roller press. If the goods were cold pressed they went through easily, but when hot they stuck fast. The reason was only discovered after weeks of investigation. It was as follows: the maker of the press had altered the trough. He had made it hollow so that it could be warmed, and had then inserted directly under the roller a bridge or partition to strengthen it, so that the trough was hollow at the sides only. On heating the apparatus the side walls expanded and closed upon the roller, while the middle of the trough was prevented from expanding so much by the partition. Hence the roller was unsupported in the middle of the trough, and the goods could not be moved along by it. When a new trough without a bridge was put in, the trouble vanished. Of late it has again become the practice to put these bridges, but so that over-expansion of the side walls is prevented.

XV. BURLING TINCTURE STAINS.

Little need be said about these, for it is evident that if the tincture is carelessly used it is bound to produce stains.

There should be a rule in every factory that the goods after each process should be stretched out by two men without waiting till they come from the dye-house, when the dyer, because the goods were in his hands last, has to bear the blame of any shortcomings. He is, of course, sometimes in fault, but not so often as he is supposed to be.

CHAPTER XVI.

LOOSE COLOURS AND WRONG SHADES.

It is hardly necessary to remark that a fabric is defective if dyed with loose colours when it might have been done with fast ones. Dyeing may be made loose, not only by the defect of the dyes themselves, but by the goods having been dyed when not properly clean.

Much might be said about dirty wool and yarn. For example, it has become the practice with cheap articles, such as confection goods, to use shoddy wool only. In this case certain dyes, ordinarily fast on wool, may be loose. A dye may be called loose because it will not stand severe washing or milling. The following query has appeared in the inquiry column of a dyeing paper: Why does a dye bleed so under the action of a soda lye of 20° B.? Delicate colours should be kept as far from soda and strong soaps as possible, and be treated with ammonia and mild soaps or with plenty of fuller's earth.

WRONG SHADES.

By wrong shades we mean such as have not come out according to sample.

They may result—

- (a) When different dyes are used from those in the sample.
- (b) When the goods are dyed at a different temperature, or with less or more boiling than the sample.
- (c) By the raw material being different from that of the sample.

(*d*) When, although the raw material is the same, the processes preliminary to dyeing have been different. For example, if the sample shows a pure white and the piece a dirty or yellowish white. On such a white it is impossible to dye light mode shades, for which pure white pieces must be chosen, instead of giving the dyer the first stuff that comes handy.

(*e*) When the carbonising has been differently done, but the wool is the same and has been washed in the same way.

(*f*) If the yarn used is harder or softer, or twisted in another direction from that of the sample.

(*g*) When, although the sample and the piece are alike in all other respects, one has been dried under cover, the other in the open air.

(*h*) When the warps are different, some heavily and some lightly sized, so that the first had to be worked very wet and the others nearly dry. In very wet weaving the warp threads get much softened, and, being rubbed by the motion of the reed, are roughened, and so dye darker than if they had been weaved dry.

(*i*) If, while alike in other respects, the pieces have been washed with different wash liquids, and also if one was more felted than the other or freer than it from grease and soap.

(*j*) If one piece is more raised than the other.

(*k*) If one piece is more strongly pressed or decatized than the other, and has therefore a different lustre.

(*l*) If one piece is more shorn than the other. With high shearing the piece dyes darker than with close shearing.

Before accusing the dyer when anything goes wrong, each person concerned with the other processes should consult his conscience and see whether he is to blame.

CHAPTER XVII.

BADLY DYED SELVEDGES OR EDGES.

AFTER what has been said in Chapters IX., X., XI. and XV., little is left for mention here, but I may call attention to some wrong methods of treatment.

(a) It often happens that pieces are too wide for the dye vat. If the vat is too full the selvedges are then brought into immediate contact with the sides of the vat and get dyed darker, especially if aniline dyes are being used in a copper pan.

(b) It often happens that goods insufficiently rinsed after mordanting, centrifuged after carbonising, as well as goods in which residues of alkalies from milling, washing or neutralising, have been hanging a long time over a horse, so that the liquids accumulate in the selvedges. These then usually dye darker than the rest. The same happens if dirty goods hang on a frame so that the residues gravitate into one part, and cause dark edges.

(c) Sometimes goods lie wet exposed to the sun for one or more days, mordanted or unmordanted, and only covered on the top without paying any heed to the sides of the pile. If the sun only reaches the selvedges no harm is done, but the goods are often irregularly piled and then the result is parti-coloured selvedges or edges.

(d) Often the goods are not protected from water drops falling on the right side. Uneven dyed edges may also result from uneven cooling after decatizing. This occurs when

several rollers are piled up or laid singly on a bad conductor of heat, and invariably causes unlevel dyeing.

(e) Defective selvages are often caused by using the old system of dyeing in the indigo vat in which the goods are wound off one roller on to another and back again, both rollers being immersed. With this arrangement the selvages are in contact with the dye the whole time, while the middle of the piece is occasionally protected from it by being wrapped on a roller. Hence the selvages are dyed much more deeply than the middle.

(f) A further cause of dark dye stains is when the goods run full width on the winch. They then cool faster at the edges than in the middle, and the dyeing becomes unlevel. This happens especially if too much bichromate of potash is used in mordanting.

CHAPTER XVIII.

HARD GOODS.

THIRTY to forty years ago it was the universal opinion that cloth could only be good and strong if it was hard and stiff. This idea has now disappeared, and soft elastic goods are preferred. Hard goods may result—

(a) By the use of too hot or too alkaline baths in scouring or leaving the wool in them too long.

(b) If the wool is dried for too long or at too high a temperature.

(c) If the wool or cloth is carbonised with too much acid, or has been neutralised with too strong lyes.

(d) If the wool or cloth has been exposed to too high a temperature in the drying-room on carbonising, or for too long.

(e) If the wool has been chemically acted on by over-mordanting, too long boiling in the dye bath, or over-filling of the dye vat. Too long continuance of hot baths not only makes the wool hard and brittle, but felts very much. If the boiling is done with direct steam the material is especially apt to felt near where the steam enters. That the fibre is hardened is often made clear when different colours are dyed on the same batch. It often happens that while the white yarn will give 18,000 to 20,000 metres per kilo., the same yarn after dyeing will only give 12,000 to 14,000 metres, especially with dark colours like brown and black. Hence care must be taken to spare the goods as much as possible in dyeing.

(f) If the yarn is over-twisted in spinning or doubling.

(g) If the weft or warp yarn is steamed too long or too hot.

(h) In certain goods by too close spacing and by hurrying the loom.

(i) If too strong alkalies or acids are used in washing and milling, or if of the proper strength, act too long. In washing and milling soft goods soda should be used instead of potash, and only good soap and fuller's earth, or ammonia.

(j) If the milling lasts too long and is done too dry.

(k) If the goods are attacked by too strong mordants or repeated dyeings, or lifted too hot, without cooling the bath with cold water. They then not only get hard but easily get dye or heat creases.

(l) By over-sharp decatizing. Little need here be said, as every expert knows that too long decatizing makes goods hard and brittle.

CHAPTER XIX.

BRITTLE GOODS.

By these we understand those not strong enough for the purpose in hand, and threads may be usable therefore for one purpose and not for another, where the cloth has to bear hard wear. Brittleness may be caused—

1. By the nature of the raw material.
2. By wrong handling in washing, burring, carbonising, drying, dyeing or spinning.
3. By over-steaming the yarn.
4. By improper wefting.
5. By unsuitable weave.
6. By unsuitable washing and milling.
7. By unsuitable piece carbonising.
8. By unsuitable shearing.
9. By unsuitable piece dyeing.
10. By unsuitable decatizing.
11. By unsuitable raising.
12. By unsuitable drying.

I. BAD MATERIALS.

It is obvious that strength cannot be secured with short staples, *e.g.*, with shoddy or waste, or with wool which has been impaired in strength, say by lying wet in a ship's hold, or especially by sea water.

II. WRONG HANDLING IN WASHING, BURRING, CARBONISING, DRYING, DYEING OR SPINNING.

I refer first to pp. 3-4 and then call attention to a special case which occurred two and a half years ago at Verviers.

For a large spinning batch carbonised wool had been chiefly used. Several weeks after spinning the wool was woven. In the meantime the yarn had so deteriorated that it was hardly weavable although it had given no trouble in spinning. Investigation showed that the yarn had never been properly neutralised, but whether the acid residue resulted from insufficient neutralisation or from total omission of that process could not be discovered. Spinning itself may make the goods brittle if they are over-carded or when the wool is spun out too fine for its quality and the threads become tapering and uneven and lose therefore in strength and durability.

III. OVER-STEAMING OF THE YARN.

This may affect the strength of the yarn. On p. 869 of vol. i. of the *Handbuch der Weberei* it was shown that the strength of 2/80s yarn was lessened by 15·78 per cent. by seven minutes' steaming, that of 2/45s by 9·67 per cent., and that of 2/32s¹ by 6·55 per cent. Hence the manufacturer will do better by sizing his warps than by steaming them, and anyhow he ought to keep a moderate temperature in steaming.

IV. IMPROPER WARP SPACING.

This often happens in inexperienced hands. If the warp is too close, it does not take up enough weft and the fabric becomes weak across the piece. If the case is *vice versâ*, the cloth is weakened lengthways. The latter case is worst with trouserings.

V. UNSUITABLE WEAVE.

This occurs when either warp or weft threads, or both, are left bare too far, so that proper interweaving of the two is impossible. Also when the crossings are so strong that the fabric does not take up enough weft. See Chapter VIII.

¹ Metrical counts.—Tr.

VI. WASHING AND MILLING.

See p. 149.

VII. PIECE CARBONISING.

See Chapter XVIII. and also pp. 151 and 152.

VIII. SHEARING.

Here brittleness is often caused by setting the knives too deep.

IX. PIECE DYEING.

Refer to "dyeing stains," pp. 135 *seq.* and 149.

I have had an instructive example of this. A sample of white yarn gave an average tensile strength of 105 kilos. with five tests. After it had been dyed black, I do not know with how many or how long boilings, the tensile strength went down to 94 kilos. Hence it is advisable to boil such goods neither too long nor too often.

X. DECATISING.

I have already said on p. 152 that steaming the yarns lessens their strength. The same holds true of decatizing.

XI. RAISING.

Here refer to Chapter XII. It may be added that if the goods can bear another milling it should be given, and they should be finished like meltons.

XII. DRYING.

This fault is not common, but if the goods are over-stretched in drying, either in length or breadth, their proper treatment is over-done and the piece is damaged. If the goods are dried too long and at too high a temperature, the wool is weakened

and made hard and brittle. If a piece with broken threads is steamed, the breaks become more conspicuous. To get rid of the breaks sew the selvages together and mill down their length by 1 to 2 per cent. Then unsew, rinse, heat in water of 40° C., let the piece stay on the rollers over-night, dry and then press them at once, and decatise without steaming.

CHAPTER XX.

INDISTINCT PATTERNS.

HERE we mean such finished articles as do not show the pattern distinctly or are unevenly dyed. For this there are the six following causes : (1) if the goods were made with materials too nearly alike or cross weavings for the production of the desired design ; (2) if many coloured yarns, like melangés or certain doubles, dirtily spun, are used ; (3) if the goods have not been well washed ; (4) if one or more dyes, through looseness or unskilled treatment, have bled in washing, milling or decatizing ; (5) if goods with a raised finish do not show the desired patterns clearly enough in the threads or thread groups ; (6) if in goods with a close finish the crossings of the threads are imperfectly marked.

I. GOODS INDISTINCT THROUGH TOO SLIGHT DIFFERENCES IN DYE, MATERIAL OR WEAVE.

If we wish to make a pattern, whether by variously coloured threads or different cross weavings, and there is the not sufficient contrast alluded to, we get an indistinct pattern. Although most customers object to too striking patterns, most if not all buyers like to have the pattern distinct. Much indistinct cloth looks as if full of errors in yarn or weave, and especially if they have been close finished.

II. GOODS INDISTINCT FROM COLOURED DIRTILY SPUN YARNS.

Until a short time ago this was the cause of most of the indistinctness occurring in certain melange-doubled stuff,

especially worsteds. But since the introduction of the Vigoureux dyeing (*i.e.*, dyeing the slubbing) matters have been improved. It was first applied to this sort of goods.



Fig. 52.



Fig. 53.

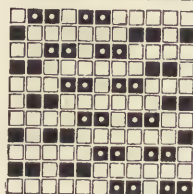


Fig. 54.

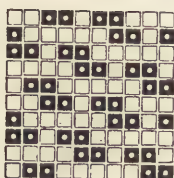


Fig. 55.

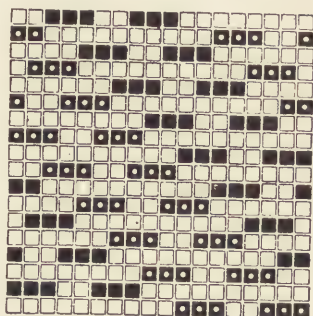


Fig. 56.



Fig. 57.

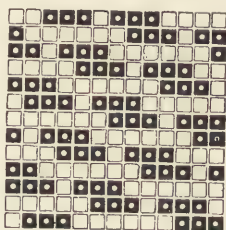


Fig. 58.

Fig. 59.

Fig. 60.

But articles prepared by his method are unfortunately not fast enough to washing and milling for men's clothes.

If with melange-doubled goods crossings are used so as to combine warp and weft effects about equally, it is always possible to get a clear result. The case is different if either warp

or weft has to cover the right side completely, *i.e.*, when the effect has to depend on warp or weft alone. If the dyes differ much from one another it is impossible to get a distinct pattern with the usual crossings. By using crossings with the new strengthening methods we get a much better result, and, in most cases, one which is quite satisfactory.

Fig. 52 gives a 3-leaved twill warp effect. Here the same thread acts in the same direction. In Fig. 53 we have the same twill, but the odd and even warp threads act alternately. If now an odd thread is too dark or too light it produces more than 50 per cent. of the effect on the right side, for the next thread goes to the right side instead of it. In Fig. 54 we have the same cross weaving on the right side, except that every thread gets to the right side twice in succession, so that the goods become heavier as it is usually intended they should. In Figs. 53 and 54 a change takes place in the ratio 1 : 1. But the ratios 2 : 1, 3 : 1, etc., can also be used. In Fig. 55 we have 2 : 1. In Fig. 56 we have 4-leaved twill warp effect. If we set it in the way above stated we get Fig. 57 or 58, according as we use 1 : 1 or 2 : 1. As a last example we take Fig. 59 and Fig. 60, which shows the change to 1 : 1.

For further information see my little book *Verstärkung von Geweben ohne besondere Faden*, price M.2.25. If a weft effect is desired with melange or doubled yarns we can treat the weft in a similar manner, or we can use the same weave given above if we turn them through a right angle and use the side undermost in the loom as the right side.

III. INDISTINCTNESS FROM BAD PIECE WASHING.

Little need here be said, as it is evident that distinctness is conditional on proper washing.

IV. INDISTINCTNESS FROM BLEEDING OF DYES.

If a dye is loose in its nature, it stands to common sense it will not resist thorough washing, to say nothing of milling. Nevertheless, a dye is not loose in the true sense if it only fails to resist these operations, combined with great heat or alkalinity. Light colours and even white may lose freshness by too prolonged decatising and get a yellowish hue.

V. INDISTINCTNESS IN RAISED FINISH.

Here we mean goods with patterns constituted by a special grouping of raised or prostrate threads and not showing clearly. The following factors affect this: (a) the choice of raw material; (b) the management of washing, carbonising, carding and dyeing; (c) the twist of the yarn; (d) the management of the loom; (e) the cross weaving; (f) washing, milling and finishing.

As regards raw material, it has to be chosen according as we want a short, fine and close finish, or a nap of long and coarser hairs. In the first case short staples are chosen, for short fine material contains more separate ends to the pound than long coarse stuff. In the second case long staples are chosen. For the treatment of raw material needed to get a soft and clear cloth with a raised finish, see Chapters II. and XVIII.

As to the twist, two important points have to be noted, the degree and the direction of the twist. As regards the former the yarn of special importance on the right side should not be twisted harder than is necessary to give enough strength. Then the felting goes on quickly and the gig has an easy task as the threads are easily scratched out of the fabric. As regards direction, take care that both in weft and warp of twills it follows that of the twill.

If, for example, we take Figs. 61 and 62 we see that in both the twill runs to the right. Hence to prevent the twill

effect from being too conspicuous we twist the warp yarn to the right, but the weft yarn to the left, as it has a different position in the fabric. Then its twist also follows the direction of the twill and mingles correctly with the warp as shown on pp. 675 *seq.* in vol. ii. of the *Handbuch der Weberei*. This also facilitates the picking of the shuttle and the subsequent milling.



FIG. 61.



FIG. 62.

With special weaves, basket weaving, granites and others the weft should be twisted the opposite way from the warp. With regard to the loom too close spacing is to be avoided, and as regards the weave attention must be given to two factors, first to the nature of the material; the shorter it is the closer the weave must be, although the exposed parts of the warp must be long enough to give the necessary hairs in raising. The staple of the material must, of course, correspond to the nature of the finish. Secondly, the grouping of the exposed parts must correspond to the pattern wanted.

Washing, milling, raising, shearing and beetling all exert much influence on the production of distinct patterns with a raised finish. First the necessary felting must be got by washing and milling, and the felt must then be raised, tearing up the exposed places partly or entirely, according to the sort of goods, and then shorn or beetled. To detail these processes is not within the scope of this book, but rather belongs to a work on finishing.

VI. INDISTINCTNESS IN CLOSE FINISH.

The following may be the causes of error: (a) improper choice of raw material; (b) wrong washing, carbonising, dyeing or carding; (c) wrong yarn twist; (d) spacing on the loom; (e) the cross weaving; (f) the warp bearing too heavily on the shuttle race; (g) over-severe washing; (h) over-felting in milling; (i) over-carbonising; (k) improper

raising; (*l*) over-boiling or the use of too strong mordants; (*m*) insufficient shearing or gassing; (*n*) bad decatizing.

(*a*) Only long staples are suitable for close finishes, such as carded yarns and slivers. All short staples such as noils and shoddy must be absolutely rejected, whether alone or mixed with better wool.

(*b*) In these processes all felting must be scrupulously guarded against (see Chapter II.). In carding it is as well to work the wool as little as possible, and not to cross it if the machine will allow. There are now machines with which we can get a uniform thread without crossing. I mean whole and half-carded yarns and others.

(*c*) With regard to wrong twist we have to consider errors in degree and in direction. Warp and weft yarns have to be twisted rather tight, that they may not felt too much during washing, dyeing and milling. For such goods, in the interest of a close finish, the yarns should be carefully damped before weaving.

As regards direction, the opposite of that stated on p. 158 obtains here, and the twist must be in the opposite direction to the twill. In the case represented in Figs. 61 and 62 we have to twist to the left in the warp and to the right in the weft.

(*d*) As regards spacing, a fabric to be close finished should be spaced as close as possible, so that if the right yarn with the right twist has been used the fabric cannot felt too much in washing and milling. As the goods cannot contract much with close spacing this must be done on the loom.

(*e*) Little need be said regarding cross weaving. The pattern, *i.e.*, the cross weaving, must be sharply marked so that the spectator can see at a glance what the pattern is meant for. If, for example, it is a question of cross or diagonal ribs, twills or similar goods, the separate divisions, whether of warp with warp, warp with weft, or weft with weft, must be clearly separated, and in the pattern itself there must be no indistinct places where the pattern changes.

(f) Over-rubbing of the warp on the shuttle race rarely occurs. Nevertheless we must remember that when it happens it is unfavourable to a close finish, as it roughens the threads.

(g) To facilitate the labour of the washer only the best grease should be used for goods intended to have a close finish, and carbonate of soda or potash should be avoided and very alkaline soaps, using instead neutral soaps and sal ammoniac. The wash liquids, too, must not be too hot, and much rubbing in washing and anything else tending to open the felt must be guarded against.

Cashmeres, merino, zanella, alpaca and some other goods should be treated before washing on the crabbing machine. This consists of from one to four pairs of rollers, with a pressure arrangement and water troughs. The goods are treated here with hot or boiling water for a time to make them felt less readily. In the absence of this machine use the boiling machine mentioned on p. 165.

With goods containing white or light shades care must be taken that the dyeing has been with fast dyes and that the rinsing has been thorough. Such goods must not be milled in grease or the light colours will come out yellowed and dirty.

(h) To prevent over-felting the goods should be spaced very close and woven very firmly, if possible, even at the cost of having to keep the goods longer in the washing machine. If they are milled, too much rubbing and too high temperatures must be avoided, and the machine must be kept open during the process.

(i) Defective carbonisation by using too much acid, leaving the goods too long soured, handling them too much in the acid bath, or drying them too quickly or too long injures the fibres, and so that smoothness which is essential to a close finish.

(k) As regards raising, any felting produced in washing or

milling must be undone for a close finish, so that the goods must, if necessary, be repeatedly treated with more or less weak or sharp cards. If there is strong felting it is as well, after the first raising, to dry the goods, then to look after snarls, shear, raise again and so on.

If, however, as was formerly often the case, the goods were spaced loose and thoroughly felted by milling the gig must bite much deeper. This must be to the damage of materials and to the weakening of the piece, and never leaves behind such a round full thread. In sharp raising and going right down to the ground the goods must not be too wet.

(l) Much need not be said about over-boiling in dyeing, for it is clear that over-boiling and the use of strong mordants tend to felt the cloth. If strong boiling cannot be avoided the goods should be previously decatized rather more than usual, as decatizing is a good protection against felting.

(m) A fabric to have a close finish should obviously be shorn as close as possible. Here many ways can be adopted of raising prostrate hairs so that the knife can get at them, such as brushing, steaming and other suitable means, especially when it is a question of treating raised patterns, diagonal ribs, etc., in a cross shearing machine. In gassing we can burn off all the raised hairs by repeated passages or by an intenser flame. Unfortunately, the goods usually retain a burnt smell which is very difficult to get rid of.

(n) As regards decatizing, refer to pp. 139 *seq.*, but it may here be mentioned that fabrics containing white threads should be decatized as little as possible and never too hot, for fear of making the white yellowish.

CHAPTER XXI.

THE REMOVAL OF STREAKS, CREASES AND STAINS.

THE REMOVAL OF STREAKS.

WE distinguish three main causes of streaks :—

1. Yarns unlevel in material, strength or colour.
2. Defective treatment in spinning, warping, sizing, drying, beaming or weaving.
3. Improper finishing, *e.g.*, washing, milling, carbonising, raising, shearing, dyeing, etc.

The removal of streaks belonging to the first two heads and some belonging to the third, especially when the fabric is dyed in the wool, is called equalising.

In some cases, for example, when it is a question of unequal placing of some threads in the reed, or of two weft threads lying too close together, the matter can be amended in the loom by parting the threads with a needle. See Fig. 2.

Equalising proper is done after finishing and almost exclusively with goods containing two or more colours or melanges. The process is executed with charcoal made with very soft wood, such as poplar, with coloured pencils, ochres, talc, water-colours and burling tincture. The solid pigments are applied in the usual way, the liquid ones, such as rubbed-up water-colours, with brushes, sponges or pads. To apply a colour the goods are put on a horse or on a flat surface inclined at an angle of 40 to 60°. When the work is done the effect should be examined over a large surface on a horse. In applying charcoal, ochre or talc it is evidently

unnecessary to take the same pains as with water-colours, coloured chalks or burling tincture.

Before beginning the application of any colour compare it with the colours of the fabric. If it is unsuitable mix it with another or choose a fresh one till it will do. This is easily done with ochres, coloured chalk, water-colours and burling tincture. Then apply the colour carefully with a brush, sponge, etc., and spread it as evenly as possible. Then go over the work with a larger brush or sponge to get greater harmony. During the process the attendant must look at the piece from every point of view to get the effect right from all. It is evident that greater care is necessary with close than with raised finish.

In large works these operations are the work of special women, who have acquired skill by long practice, and the custom can only be recommended.

Any excess of water-colour and nearly all burling tinctures may be removed with a wet sponge or by washing the piece in water with a little neutral soap.

REMOVING CREASES.

Creases from washing, milling, decatizing, dyeing, etc., must be treated according to their intensity, *e.g.* :—

1. By thorough washing with warm water, with a little soap if necessary, on the full-width washing machine. Instead of this the piece may be soaked for from twelve to fifteen hours in soft water at 40 to 45° C., to soften the fibres. A passage through the washing machine should then follow if the creases are very bad.

2. By re-milling the piece. This is very advisable with chevots showing dyeing creases or milling creases. The re-milling must be done with neutral soap and be followed by a passage through the full-width washing machine with hot water, or through the boiling machine.

3. By wetting the goods and then leaving them for a day or two tightly wrapped on a roller.

4. By passing them through the boiling machine. As this machine is not yet universally used I will give a description of it.

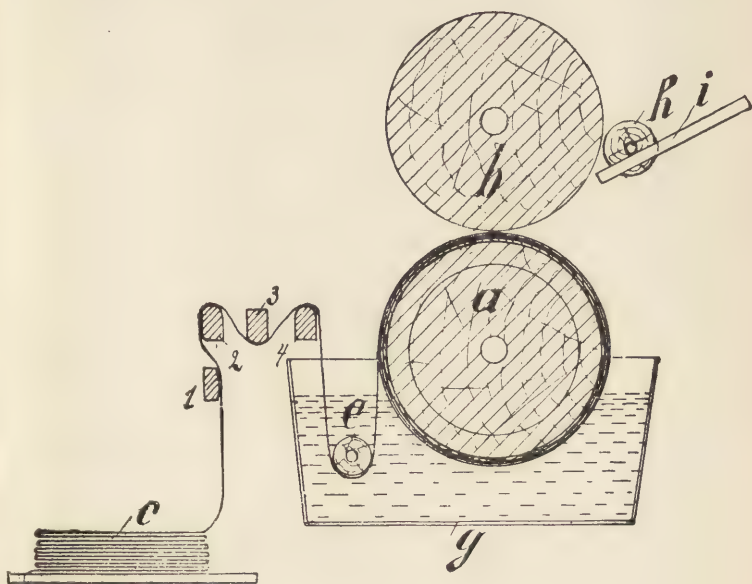


FIG. 63.

Fig. 63 shows a section of the machine. *g* is a reservoir, *a* and *b* two rollers, and *e* 1, 2, 3 and 4 guides. Nos. 2, 3 and 4 also constitute a width stretcher.

The goods *c* pass on to the lower roller which dips into hot water in *g*, and when fully wrapped on it is slowly turned for seventy-five to ninety minutes. The piece is then transferred to the roller *h*, borne on *i*, and there left for some time, according to the obstinacy of the creases. *g* is usually treated by direct steam, and the goods can be cooled by shutting off the

steam and running in cold water. The goods are usually left on *h* for sixteen to twenty-four hours, the roller being removed from the machine.

5. If creases are very obstinate the piece is stretched out wet in all directions and then decatished wet.

6. Treat as in No. 4 except that the goods are pressed in a hydraulic press before decatishing. I know of a case in which streaks were caused by a sharp-edged width stretcher on a boiling machine.

The folds mentioned on p. 92, where the weft is pressed through, cannot be remedied.

REMOVAL OF STAINS.

1. Ordinary dirt marks are got rid of by washing with water, using soap if needed.

2. Rust stains can usually be removed by cold dilute oxalic acid. They only disappear after rather long treatment. The stains should be repeatedly damped with the solution during the course of a few hours with a sponge. The goods are then washed and passed through a soda bath to neutralise any remaining acid. If the fabric is dyed and the acid has injured the colour pass through dilute ammonia.

In this and all other stain removals it is well to support the fabric on several folds of a clean cloth. If the fabric is laid on stone, wood or other hard surface the stain will spread to other parts of it. The fabric should be treated on both sides, especially with thick heavy goods. If there are many rust stains the goods should be treated with the dilute oxalic acid on the washing machine, adding the acid before putting in the goods. These are then run in the acid for a few hours till the stains have gone. The worst places are treated individually with the sponge. After treatment the piece is thoroughly rinsed in clear water and then neutralised with soda.

3. Oil stains may be divided into petroleum stains and those

of animal and vegetable oils. The latter are easily removed with benzole or ammonia, or with carbonate of soda and a little ammonia in soft water. No soda should, however, be used on sensitive dyes, but a neutral soap. Stains of petroleum are removed by supporting the place on a soft folded cloth and wetting the stain well with oleine or rape oil. After this has had time to mix with the petroleum, treat the stain with a mixture of 20 per cent. of good soap in solution, 60 per cent. ammonia and 20 per cent. acetic ether. Petroleum ether is also good for removing petroleum stains. The above mixture is applied with a clean sponge or pad, and the goods are then repeatedly washed in clean lukewarm soft water, and finally with a weak lukewarm soap bath. If the stains are large or numerous soak liberally with oleine and then wash the pieces with soap and soda in the washing machine.

4. Acid and fruit stains are removed by a mixture of 75 per cent. alcohol, 5 per cent. benzole and 20 per cent. ammonia. This also removes tar and grease. Hypochlorite of sodium also removes them quickly. In the worst cases the hypochlorite is the best thing to use.

5. Tobacco stains are removed like fruit stains.

6. Mildew stains are removed by washing if superficial only. If, however, the mildew has penetrated into the fabric there is no way of removing them, as by that time the fibre, or at least the colour, is destroyed. They appear as pale places in the finished goods. Mildewed goods should be treated with ammonia on the washing machine, and then, but not before, with soap. Sodium hypochlorite renders here too good service.

7. Soap stains from soap left in goods can be removed by washing in water. For those resulting from lime soaps, see p. 138. Silver stains can be removed almost if not quite entirely with plenty of sal ammoniac and fuller's earth.

8. Carbonising stains if very slight are removed by washing

If bad, however, they are visible after dyeing, even if the piece is dyed black.

9. Soda stains are those caused by pouring strong lye straight on to the goods in the bath used for washing, milling or neutralising. They are almost always visible after dyeing, and no washing will get rid of them. The only cure for them is prevention. See pp. 126 and 127.

10. Dye stains resulting from mildew cannot be removed. This is also usually the case with such stains in general when they proceed from carbonising. The only hope is to dye the goods black.

If, however, the stains result from the dyeing process itself, the pieces must be bleached and re-dyed or dyed darker than was originally intended.

Silver places are removed by rubbing with grass or stinging nettles.

11. Burling tincture stains are removed with a wet sponge. If the stains are large and numerous, wash on the washing machine with soap or fuller's earth. In many cases, however, plain water is enough.

12. Ink stains are almost all removed by sodium hypochlorite.

13. Decatising stains or clouds are usually removable by repeated washings in warm water followed by treatment on the boiling machine shown in Fig. 63. In very bad cases a careful wet decatising may be necessary. In less bad cases a few careful steamings give good results. A light milling is also good for moiré stains caused by decatising.

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JUNE, 1903.

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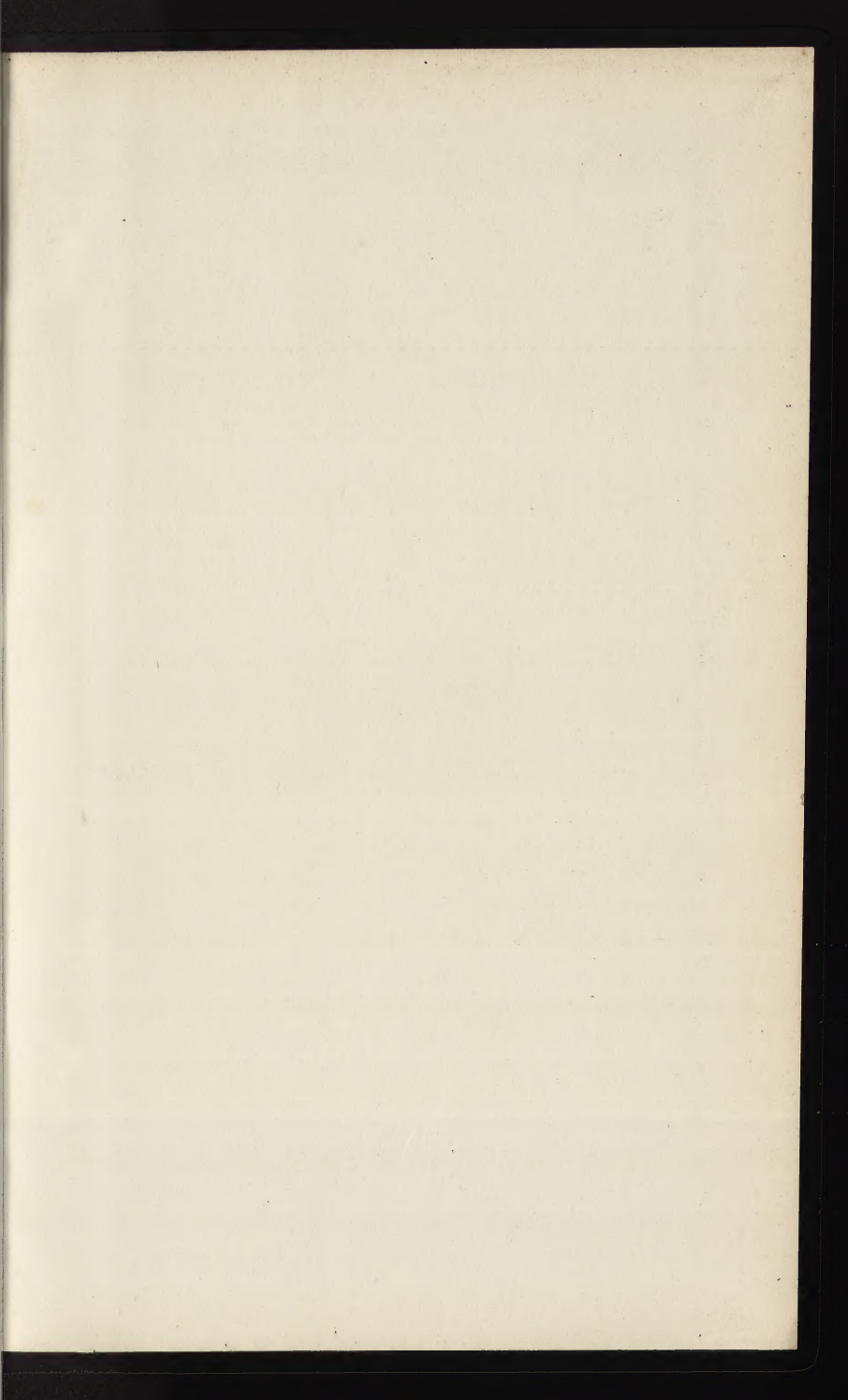
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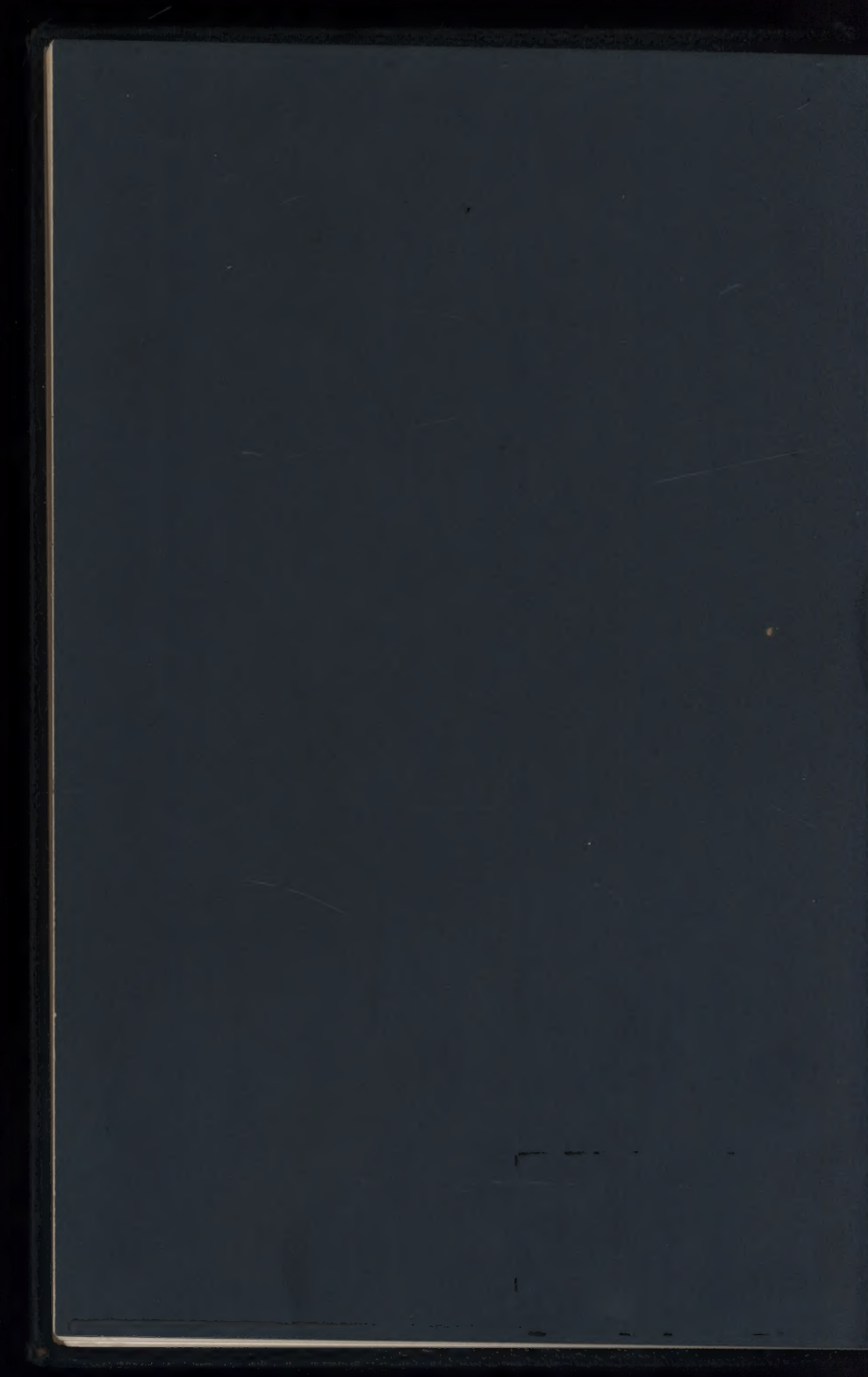
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